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The Engineering and Mining Journal

Vol. 93. MARCH 23, 1912. No. 12.

The Smelting Company's Report

The 13th annual report of the American Smelting & Refining Co. is noteworthy for two things, anyway, and perhaps for others. In the first place, it is for the first time a report for a calendar year, the old fiscal year having been abolished. This is a commendable innovation that ought to be adopted by every company. There is no reason under the sun why any company should report in any other way. In the next place this report is noteworthy for a lumping of the business of the American Smelting & Refining Co. and the American Smelters' Securities Co. With the interlocking arrangement between these two companies, clinched by the purchase last year of the outstanding common stock of the securities company by the smelting company, the latter became the unqualified controller of the former, subject only to the demands of the debenture holders of the securities company (who were guaranteed by the smelting company) and the rights of certain preferred stockholders. Incidentally we may remark that the position of the preferred stockholder in the two companies is somewhat anomalous. Some have claims upon certain equities and some upon others. However, while the dividends on the preferred stocks be paid regularly, which seems to be reasonably assured, so long as the company continues to be a going concern, we do not suppose that any objection will be raised on this ground.

The new form of the 13th report shuts off any comparison with former reports, and in general the presentation is obscure. The president of the company, in four printed pages, does not tell his stockholders anything of extraordinary interest beyond the repetition of what is stated in the balance sheet, the brief mention of plans respecting the new smeltery at Hayden, Ariz., the purchase price of the Tiro General mine, and the assurance that the stocks of silver and copper are still inventoried at 50c. per oz. and 12c. per lb., respectively, which are comfortably conservative figures.

The statement of assets and liabilities is still confused by the ledger entry for property account, and the manner of writing off for depreciation and new construction. The officials of the company no doubt are able to interpret this bookkeeping (we can't), but they keep their knowledge to themselves. We understand that the company has got the following things:

Investments	$1,585,670.35
Deferred charges	704,166.66
Reserve fund assets.....	232,554.84
Metal stocks	26,492,980.70
Working assets	2,967,021.29
Current assets	13,652,980.88
Total	$45,635,374.72

In addition to the above assets it possesses a lot of physical property, including mines and smelting works, of great but unindicated value; and goodwill, represented by its contracts, organization and generally its ability to conduct a successful business, all of which is undoubtedly also of great value. The company had obligations as follows:

Debenture bonds	$15,000,000.00
Current liabilities	8,810,109.90
Reserve funds	1,089,271.66
Total	$24,899,381.56

Consequently, the company had a surplus of about $21,000,000 in cash assets, besides the physical property, good-will, etc., that we mentioned above. The value of the latter is indicated by the ability of the company to earn money. Its showing of earning capacity in 1912 was very satisfactory. We think, however, that the stockholders would like to have (and ought to have) data to enable them to form their own opinion of continuance of earning capacity.

In the income account for 1911 there is a step in the right direction toward proper itemization, the earnings of the smelting and refining plant, the mining properties, and other sources of revenue being reported separately. We have, in previous years, criticized the Smelting Company for insufficient allowance for amortization. In 1911 the deductions on this account seem

to be liberal, although we have but an imperfect idea of the meaning of the several items. Out of gross earnings of about $14,000,000 by the smelting and refining plants, $1,944,000 is deducted for "ordinary repairs and replacements." Then out of the total gross income ($15,-112,125), the sum of $1,887,399 is deducted for "depreciation and amortization of properties." Finally, $900,210 is deducted "for depreciation in value of investments." Here we have a total writing off of about $4,700,000. We are always confused by the item of "ordinary repairs and replacements." Commonly, repairs and renewals are figured in operating expense and do not appear in the income account any more than does fuel, flux and other items of direct operating expense. The mere keeping of plants in good repair, of course, is not a figuring of amortization in any sense of the word.

We have no reason to criticize the report of the smelting company very extensively. We could not find many points to seize hold of if we tried, most of them having been rounded off, or buried. We hope that next year the directors of the company will give us a better opportunity. We may say that in their recent reports we see signs that they are moving in that direction, and we have no doubt that before the passage of many years they will issue an annual report as full, explicit and commendable as that of the Steel Corporation. We shall conclude our comments upon the 13th annual report by remarking that last year the company seems to have made a lot of money, and is, no doubt, comfortably well off, nay, even prosperous.

Will There be a Coal Strike?

Rather an unreasoning panic seems to have set in over the probability of a strike of the miners in the anthracite region. The public seems to have made up its mind that supplies of coal are to be cut off for an unknown period, and this belief is industriously fostered by coal dealers in the seaboard cities, to their own great and immediate profit. It is true that the miners and operators have apparently developed radical differences, and the miners' demands have been refused. Nevertheless the negotiations have been conducted amicably so far, and there is not only a possibility but a probability that a new set of conditions may be presented which will permit a compromise. It is probable that there may be a suspension of mining for a short time, but that no strike will be declared, and in that case the consequences to business will not be serious, especially as spring is coming on with its decreased demand.

Physical Chemistry

There has been developed during the last 25 years a new science that for convenience is referred to as "physical chemistry," although in truth it is but general chemistry interpreted in the light of physics. The beginnings of this interpretation were made much earlier than 25 years ago and in the early '80s, with the publication of Thomsen's classic "Thermochemische Untersuchungen" (1882-6), a fair practical acquaintance with one important phase of the new knowledge became general, but we think we are correct in saying that the crystallization of the new ideas occurred within the last quarter of a century and that the chemists and metallurgists who were in school before that time have still but a vague idea of modern teachings. The metallurgist who dates back to that time finds it difficult to follow the modern papers of Boudouard, Bodländer and others, for the reason that he failed to get the rudiments of the new science during his student days, a natural failure inasmuch as the science had not then been formulated and was scarcely referred to in the classrooms and textbooks. It is difficult in later years for such men to become thoroughly conversant with a new science, just as it would be difficult for a man of 45 to take up mathematics from the beginning. The mind of that age is less receptive than the youthful, and moreover the engagement with the material things of everyday life precludes the kind of application that can be given in school.

Yet the teachings of physical chemistry are something whereof the practical metallurgist needs to know, because they afford keys to further progress in the practice of the art. The cyanider wrestling with the problem of colloids is concerned with one phase of this subject that but 10 years ago did not occur to him, and the smelter has many conditions of things that may or may not be done. To most engineers who have not studied chemistry in recent years the term "physical chemistry" is one of unknown meaning, suspected of being a cloak to disguise chemical ignorance by a show of mathematical learning. It is, however, capable of presentation in relatively simple language, and in order to give some ideas about this science, introducing the basis of the newer concepts of chemistry, we invited Dr. H. C. Jones, of Johns Hopkins University, to contribute to the JOURNAL a series of articles on this subject, the first of which is presented in this issue.

A Training School for Miners

The mining department of the Cleveland-Cliffs Iron Co., at Ishpeming, Mich., is planning to conduct a training school for its employees. The company desires to select foremen and shift bosses from among its own men and those in charge of the school will endeavor to educate the miners so that they may become competent to fill these positions. Instruction in general mining and underground work will be included in the curriculum. Any able-bodied employee of the company who can read and write English may enroll in the school.

A little more than a year ago Dr. George Kirchensteiner gave a lecture at a meeting of the American Society of Mechanical Engineers in New York on the industrial training schools of Munich. Employers permit young apprentices to attend these schools at certain hours in alternate weeks or fortnights. The apprentices learn their trades in these training schools while actually engaged in the work they are studying. All who heard that lecture were convinced that such trade schools must develop efficiency.

We hope that the school of the Cleveland-Cliffs company may prove so beneficial as to stimulate other large industrial corporations to follow its lead.

Silver prices, which still continue high, seem for the moment to depend chiefly upon China. Affairs in that country are still in disturbed and uncertain condition, but there is a general impression that the new government will soon be in a sufficiently secure condition to negotiate a loan, which will require a large proportion of silver in its payment. The adjustment of currency is necessarily postponed for a time.

By the Way

One of our financial exchanges says: "Porcupine stocks are in the main stationary." Probably a printer's error, changing an "e" to an "a" in the last word.

Attention is called by the U. S. Geological Survey to the fact that it does not make analyses or assays of ores or metals for the public, and suggests that if an assay is desired the proper course is to employ a private assayer or to send the specimens to one of the government assay offices where a regular charge is made for such work. Government assay offices are situated at Carson, Nev., Seattle, Wash., Boise, Idaho, Helena, Mont., Deadwood, S. D., Salt Lake City, Utah, and Charlotte, North Carolina.

A practical application in mining technique, probably not included in any of the elaborate courses of the various mining schools, was observed recently in an Arizona district. The prospector was driving a tunnel, and in view of the active interest displayed in his operation by the rattlesnakes and Gila monsters which abounded in his locality, he fixed up a screen door which closed the tunnel and prevented its being used in a social way by these "varmints," and also by the dreaded and perhaps fabled "hydrophobia" skunk of the Southwest. It also excluded the omnipresent bats, though these are not considered objectionable by the operator.

The St. Mary's Mineral Land Co., presents an interesting outgrowth of the old-time policy of giving large land grants in payment for construction work of a public nature. The present company controls the stock of the St. Mary's Canal Mineral Land Co., which was organized in 1863, under New York laws. The latter company constructed the first ship canal at Sault Ste. Marie, Mich., and received from the State of Michigan, therefor, 180,000 acres of land in Houghton, Ontonagon and Keweenaw counties in the upper peninsula of Michigan. Among the mines that have been developed from this tract are the Calumet & Hecla, Baltic, Trimountain, Champion and others. In 1911, the St. Mary's Mineral Land Co. owned shares in Michigan copper companies as follows: Champion, 50,000; Hancock, 20,000; King Philip, 6; La Salle, 20,165; Pacific, 20,000; Copper Range, 208; Winona, 56,774; Old Colony, 80; Mayflower, 25,000; St. Mary's, 640; Ojibway, 2000; North Lake, 9000; Franklin, 1571; Houghton Copper, 37,222. During the last four years the company has paid out $993,108 in assessments. Of the above companies but four are producing, Champion, Copper Range, Winona, and Franklin, and of these only Champion and Copper Range, the former being an integral part of the latter, are paying dividends. The company owns 93,426 acres of land and mineral rights on 14,038 additional acres and at present maintains an annual dividend rate of $3 per share on its 160,000 shares. Since 1900 the policy of the company has been to sell no mineral lands outright.

Two shotfirers were recently saved at Radley, Kan., by means of a mine-telephone system. When the shotfirers were at work one evening, in the mines of the Girard Coal Co., an explosion occurred. The engineer at the surface, to whom the shotfirers reported from station to station as the blasts were set off, was able to direct the rescue party to the approximate location of the shotfirers, who were quickly taken out and resuscitated. This mine-telephone system thus not only saved the lives of these men, but from a purely business point of view, more than paid for itself in the elimination of damages that would probably have accrued in the event of these men not being rescued.

"No," said the Michigan miner, "mining ain't what it used to be in the days when good miners were scarce and got high pay. I recall in the old ——— mine before Cap'n Bill ——— died, when the miners were all Cornishmen, we'd go down in the morning and sit around till nine o'clock to smoke our pipes. The talking would finally come 'round to our work, and having laid out what we would do for the day, we'd set to and put in a few holes, shake down a bunch of ore and at half past three knock off, smoke an hour and go up. There was considerable hand drilling in those days, and the qualifications for a miner were stiffer than being able to turn the crank of a machine. I remember old Cap'n ——— who laid great stress on the miners being able to swing a hammer either handed; if he came 'round and saw you swinging left, he'd call, 'Swing her right,' and if you were swinging right, he'd say left. If you couldn't do it, up you'd go—and he himself couldn't hit a drill with a shovel. When he was 'round you was to quit work and listen to him; if a gang wanted to put up a show of undue industry before him, he'd stop it quick, 'If you can't do the work when I'm not watching, you'd better quit,' he'd say. Him it was that came up to lazy Bill Scroggin in the stope just after Bill had blasted; says he, 'Bill, I catched all the dirt in my hat; is that the best you can do?' At the ——— mine it was common practice among the men not to go in the stope after dinner on night shift; at first we left one man at the crosscut to watch out for the shift boss, but as he was doing the same as we, there was no use of keeping one good man from sleep. There was old Cap'n Dick ——— who was really general manager for his company, as the eastern officials knew nothing of practical work. After a time they began to think they had picked up a good general knowledge of mining, and tried dictating to Cap'n Dick. On such occasions the Cap'n would pack his grip and go down to Boston; said he, 'If that's the way you're going to do it, I have to inform you that these's a vacancy in your Lake Superior mining department,' and he always got his way. Iron was high then, and we got good wages, a dollar a car; yet, the men took it easy you might say, but all our work counted, and they were all good miners then. We got our share; the company made considerable, and all were satisfied."

Alchemy is again to the fore. Workers on the green-gold myth and catchers of volatile gold may cease their efforts in the Adirondack country and elsewhere. According to dispatches, one M. Verley, an inventor in Paris, has discovered the secret of the manufacture of gold out of baser metals. He warns the public that he must not be compared with Lemoine, the diamond fakir, nor with alchemists of the past, and has invited all the governments of the world to a conference for the purpose of making the production of gold a state monopoly. Reporters, however, have been unable to find the alleged "gold factory," which was to turn out tons of yellow metal from mere scrap iron, and we therefore conclude that monetary commissions will not be compelled to halt their deliberations on this account.

We have all been "up in the air" at various times in our hunt for gold but this heading of a Canadian dispatch, "Balloon Hunt for Gold," does not refer to exactly this sort of aeronautics. However, it may develop that it is only another way of reaching the same point. At any rate the dispatch chronicles that. A. E. Clarke, of Toronto, is preparing to make a 500-mile dash by balloon from Cockrane to Ungava, the vast unexplored no-man's land, lying north of Quebec, west of Labrador and east of Hudson Strait, in search of gold. He hopes to beat a party of eleven men whom New York and Toronto capitalists are providing with money to go into Ungava to confirm the stories about the gold fields. This party will sail from St. Johns, Newfoundland, May 16, with a year's supply of provisions. It will be recalled that some mention was made in these columns a few weeks ago of a party that had started overland from Cobalt for Ungava. That the Ungava gold fields are to receive earnest attention is evident by a charter which has been issued by the government for the expedition that is outfitting to sail from St. Johns, the Ungava Exploration Co., being the title under which the New York and Toronto syndicate will operate.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Where the Primer Should Go

Replying to my notes on the position of the primer, Harvey S. Brown, in the JOURNAL of Mar. 16, 1912, is rather emphatic in his disapproval of my contention that in blasting with dynamite and fuse the primer should be placed at the top of the charge. My reason, as stated in the JOURNAL of Mar. 2, 1912, was that if placed in any other position there was danger of the explosive being deflagrated from "side-spitting" of the fuse, in which event it would not develop as much rending power as it would if detonated. I believe the majority of experts on the use of explosives will agree with me in this contention.

If a piece of ordinary mine fuse be threaded through a series of dynamite cartridges and one end of the fuse be ignited, it will usually happen that the powder will be ignited from "side-spitting" of the fuse. I have tried this experiment many times and have rarely seen the fuse burn to the end without deflagration of the powder. There is manufactured a special brand of fuse in which the faults of intense smoking and side-spitting are reduced as much as possible, but at the sacrifice of regularity in burning and water-resisting qualities. Probably this is the fuse to which Mr. Brown refers, but, in my experience, I have not found that it is extensively used. I do not believe that it would be considered good practice to load a hole so that the fuse had to burn past eight sticks of powder before reaching the cap, when ordinary safety fuse is used.

The argument against my recommendation, that there is danger of the collars of the later holes being knocked off by the shock of those going before, is well taken. I can readily understand how such a result would cause a misfire by tearing the fuse or cutting off the primer and perhaps other cartridges below it, but I have never had that experience in practice. If such trouble were experienced it seems to me that by a different arrangement of the holes or different sequence in firing the difficulty might be overcome. Furthermore, would this not indicate that the later holes were too heavily loaded? Nine sticks of powder in one 5-ft. hole is a heavier charge than I have ever had to use. It would be interesting to learn the diameter of the drill hole. If it is common practice at any mine to use so much powder in a hole 5 ft. deep it would seem to me to be advisable to drill larger holes so that the charge of powder would not fill it so full that there would be danger of tearing out the primer by the firing of an adjacent hole.

CLARENCE C. SEMPLE.

New York, Mar. 18, 1912.

Research Work in the Technical Schools

After reading the article of "An Assayer," discussing research work in the technical schools, p. 203 of the JOURNAL of Jan. 27, I would like to say that I agree with him in certain statements made, but take a different view of the situation with regard to certain others.

It is very true that assaying is considered a rule of thumb matter in some schools, and also in some custom work. In the schools it is possible to place temporarily the blame on inefficient equipment, but too often we find the instruction being handled by a student assistant who gathered his fund of knowledge of the subject while a member of the class just ahead of the one he is trying to teach. Also in many schools there are an incongruous lot of samples that are not representative ores at all, but are "cleanups" of the laboratory. The student is rarely shown a sample of the ore in an uncrushed state, and it is not uncommon to find among these samples unusual combinations, such as hematite, which has been mixed with galena; copper carbonates mixed with pyrite, and many others.

It seems to me that the instruction in assaying should be so systematic that no matter what amount is done, the student is personally conducted from the first, inasmuch as manipulation plays such an important part. Manipulation cannot be taught by reading textbooks in the classroom, but must be learned by personal contact with one who knows the work thoroughly.

For this instruction there should be one teacher or instructor to eight or ten students, and he should be in the laboratory during the entire laboratory period, to criticize and point out the reasons for carrying out the operations as they should be and to answer the numerous questions that necessarily arise. It is almost needless to add that different instructors should have their work so well coördinated that the answers given to the questions will not be conflicting. Lectures in assaying are of the greatest importance and have their own ground which they cover admirably, but it is not possible to teach manipulation from a lecture platform.

There is much to be said in defense of the present practice in teaching assaying in the mining schools. The curriculum is crowded even to cover the elementary subjects necessary to a mining-engineer's training. It is practically impossible under such conditions to devote more time to the subject of assaying than is necessary to train a student in the fundamental principles of the work. However, this training can be systematic and accurate, so that the student should be able to develop his knowledge to meet any circumstances which may arise in an assay office later.

To train a student so that he will be capable of "running 30 to 50 samples in triplicate, the first day he goes to work" is not what the schools are attempting to do, and is not what is expected of a student just out of college. My experience has been that even when an experienced assayer is engaged by a mining company he is given about a week in which to get his bearings and to adapt himself to his new conditions. If he makes his beginning in the assay office of a smelting company, he will be given a week in which to learn the routine in connection with a part of the work, either cupelling, weighing and mixing charges, weighing and parting, etc. He is only one unit in an office force that is capable of doing a large amount of work each day.

I hope to be able to present to the readers of the JOURNAL, in the near future, what I think a course in assaying should be.

L. W. BAHNEY.

New Haven, Conn., Mar. 7, 1912.

Bat Guano

Referring to the note in the JOURNAL of March 9, on the exportation of bat guano from Mexico, it is understood that the conservation craze has struck Mexico, and that the Department of Fomento has recommended the prohibition of future guano exports. This seems to be quite in line with German potash regulation, and the reservation of certain Chilean nitrate fields for domestic use. When will Spanish pyrites and American phosphate be looked after?

A. A. NASON.

St. Louis, Mo., Mar. 14, 1912.

American Smelting & Refining Co.

The thirteenth annual report of the American Smelting & Refining Co., covers the year ended Dec. 31, 1911, the fiscal year having been altered to correspond with the calendar year, and for purposes of better comparison the full year was taken, although a portion of it had already been covered by the previous annual report.

Owing to the fact that the American Smelting & Refining Co. now owns the entire issue of common stock of the American Smelters' Securities Co., and is entitled to all the earnings of that company over interest charges and preferred-stock dividends, the income account and balance sheets of the two companies are presented in consolidated form, and all inter-company accounts and entries eliminated.

CONSOLIDATED INCOME ACCOUNT, CALENDAR YEAR 1911
A. S. & R. CO. AND A. S. S. CO.

Earnings of smelting and refining operations, repairs and replacements not deducted	$14,045,334
Less repairs and replacements	1,944,593
	$12,100,761
Earnings from mining property	2,000,187
Other earnings and income	1,011,177
Gross income	$15,112,125
Deduct:	
Corporate and excise taxes	114,198
Administrative expense	767,982
Depreciation and amortization	1,887,399
Total deductions	2,769,579
Net income before deducting fixed charges	12,342,546
Fixed charges and preferred stock dividends:	
Interest and discount on A. S. S. debenture bonds	870,833
Dividends on A. S. & R. preferred stock	3,500,000
Dividends on A. S. S. preferred stock	2,520,000
	$6,890,833
Net income in excess of fixed charges and preferred stock dividends	$5,451,713
Less dividends on A. S. & R. common stock	$2,000,000
	$3,451,713
Adjusted surplus as at Jan. 1, 1911	11,148,223
	$14,599,936
Deduct	
Depreciation in investments	900,210
Surplus as at Dec. 31, 1911, as per consolidated balance sheet	$13,699,726

The previously issued reports of the companies covered to April 30 for the Smelting company, and May 31 for the Securities company. Since those dates the two companies have expended $2,131,692 on new properties and construction. This includes about $600,000 for the still uncompleted smeltery at Hayden, Ariz., which is being built by the American Smelting & Refining Co. pursuant to a contract with the Ray Consolidated Copper Co., for smelting the products of that company's mines. The plant, it is expected, will also have excess capacity to take care of other ores of the vicinity. The above expenditure also covers $550,000 paid for the Tiro General mine, lying adjacent to the Matehuala, Mex., plant of the Smelting company.

CONSOLIDATED BALANCE SHEET AS OF DEC. 15, 1911
A. S. & R. CO. AND A. S. S. CO.

ASSETS

Cost of property owned by the two companies		$178,152,497
Less depreciation and new construction	$26,188,764	
Less difference between A. S. S. Co.'s common stock par and A. S. & R. valuation of same	12,000,000	38,188,764
Net value of property account		$139,963,733
Investments, book value		1,585,670
Deferred charge, discount on A. S. S. Co.'s debenture bonds		704,167
Insurance fund securities, at cost		232,555
Metal stocks, book value of refined metal[1]	32,473,186	
Less unearned treatment charges	5,980,205	26,492,981
Materials and supplies	2,566,872	
Prepaid expenses	400,149	2,967,021
Accounts collectible	4,236,519	
Loans to affiliated companies	333,705	
Demand loans secured by copper in process	3,192,049	
Cash	5,890,708	13,652,981
		$185,599,108

LIABILITIES

A. S. & R. common stock[2]		$50,000,000
A. S. & R. preferred stock		50,000,000
A. S. S. Co. preferred A		17,000,000
A. S .S. Co. preferred B		30,000,000
A. S. S. Co. debenture bonds		15,000,000
Drafts in transit	1,555,044	
Employes' savings deposits	116,404	
Accrued taxes	198,493	
Accrued bond interest (due Feb. 1)	379,125	
Unclaimed dividends	15,760	
A. S. & R., pfd. div., payable Jan. 2	875,000	
A. S. & R. pfd., payable Mar. 1	583,333	
A. S. & R., com. div., payable Jan. 15	500,000	
A. S. & R., com. div., payable Mar. 15	333,333	
A. S. S., pf. A and B. divs., Feb. 1	210,000	
Current accounts and wages	4,043,617	8,810,110
Employes' benefit funds	394,436	
Operating suspense accounts	335,948	
Insurance fund	358,888	
		1,089,272
Profit and loss		13,699,726
		$185,599,108

[1]Does not include metals on hand refined for tolls and deliverable to consignors (approximately $7,981,840).
[2]$15,000,000 additional common stock in possession of trustee for conversion of A. S. S. Co.'s debenture bonds.

During the same periods there was credited to the property account $791,667, the regular appropriation for depreciation, and a further credit of $637,399, representing special appropriations for adjustment of property values. The property account was also reduced by $12,000,000, the difference between the par value of the Securities common stock, and its appraised value of $18,000,000 on the Smelting company books, and the common stock issue of the Securities company is omitted from the balance sheet, as being only an inter-company account. The book value of investments not controlled by the Smelting or Securities companies was written down by $900,210 from their value as at the last annual reports.

While the operation of the mines and smelteries in Mexico was interfered with by strikes and traffic disturbances, the company suffered only minor losses of property. Attention is called to the fact that in spite of the shutdown of the Chihuahua plant, and the diminished earnings of the other smelting and mining properties in Mexico, the diversity of interests and the broadened sphere of business activity of the companies has kept earnings nearly level.

In the balance sheet as presented the inventory value of silver is taken at 50c. per oz. and copper at 12c. per lb. and no enhancement in the value of the metals is shown in the income account.

Mining Accidents in Ontario

TORONTO CORRESPONDENCE

A report by E. T. Corkill, provincial inspector of mines, issued by the Ontario Bureau of Mines, shows that in 1911, 49 men were killed in accidents at mines, metallurgical works and quarries regulated by the mining act. The number of men killed and injured is distributed as follows: Mines, 36 killed and 86 injured; metallurgical works, 9 killed and 25 injured; quarries, 4 killed.

The number of men employed at mines is approximately 9423, so that the ratio of men killed was 3.82 per 1000. The causes of fatalities underground were: Falls of ground, 2; shaft accidents, 8; explosive accidents, 16; miscellaneous, 7. Of the three men killed on the surface, 2 were the victims of an explosion. These figures show a marked decrease in the accidents from falls of ground and in surface casualties, but a large increase in those caused by explosives.

The following classification distributes the responsibility for the causes of the fatal mine accidents: Due to dangers inherent in the work, 10; arising out of defects in the mine workings, 10; due to fault of fellow workman, 2; due to fault of injured person, 14. Of the 86 non-fatal accidents, 12 were due to explosives. The inspector notes that the provisions of the mining regulations most frequently broken by the workmen are those referring to the use of explosives.

Eight Hour Shift in Lake Superior Iron Mines

NEGAUNEE CORRESPONDENCE

Most of the large iron-mining companies in Michigan and Minnesota have recently changed from a 10-hour shift to an 8-hour shift for all underground work. It is not yet definitely known how many of the smaller organizations will accept the change, but the Oliver Iron Mining Co., which is the mining department of the U. S. Steel Corporation, in the Lake Superior district, the Cleveland-Cliffs Iron Co., which is the largest operator on the Marquette Range, the Republic Iron & Steel Co., the Pickands-Mather companies, the Jones & Laughlin companies, the Breitung companies and the Volunteer Ore Co. have adopted the 8-hour system. Other companies will also make the change, and it is probable that shortly all the iron mines will be working under the new rules. Several thousand men are affected by the change, which was the result of a conference of mine managers of the different companies.

W. J. Olcott, president of the Oliver Iron Mining Co., made the following announcement in regard to hours of labor at the company's mines:

> Beginning Monday morning, Mar. 11, there will be inaugurated a change in the underground labor of the iron mines on the various ranges in the Lake Superior district. The matter has been considered for some time with a view of shortening the hours of underground labor and of making same conform more closely to the hours worked by men employed in the various departments of surface labor.
>
> Under the new arrangement miners and underground laborers are to be in their places ready for work at 8 a.m., and work until 12 noon. There will be a period of rest until 1 p.m., and they are supposed to continue at work in their places until 5 p.m., thus making two periods of four hours each, with an hour of rest between. Where two shifts are employed, the men of the night shift will be in their places underground at 8 p.m., work until midnight, rest and lunch from 12 o'clock till 1 a.m., resume work at one o'clock and stop at 5 a.m. The Saturday night shift will start work at 6 p.m., and end at eleven o'clock.

The last provision, concerning Saturday night work, is the same that applied when 10-hour shifts were in force. At mines of those companies, where speed of development or operation is desired, there will be three 8-hour shifts, from 7 a.m. to 3 p.m., from 3 p.m. to 11 p.m., and from 11 p.m. to 7 a.m. There will in no case be any reduction of wages due to the change. It is understood that the shifts in the openpit workings on the Mesabi will be kept at 10 hours.

The 8-hour shift for underground work has been successfully practiced by a few mines for several years, notably the Marquette Range properties of Jones & Laughlin and the Breitung companies.

The reasons for the widespread adoption of the 8-hour shift are many. It is believed that practically as much work is accomplished by a miner working on 8-hour shift as on 10-hour shift; he is more apt to work a greater percentage of the shift and to work harder. Less time is wasted in going to and from the change house and the place of work underground, and a somewhat shorter "spell" is taken for lunch.

Trinity Gold Mining & Reduction Co.

The second annual report of the Trinity Gold Mining & Reduction Co., recently published, gives the results of operations at the company's property in Trinity County, California, for the fiscal year ended Nov. 30, 1911. The net profit for the year was $66,265, which is about half of what was expected; but all this profit was practically made during the last half of the year.

The reduction plant was completed just at the beginning of the rainy season, making it necessary to open the glory holes, by which method the ore is mined, during the months of rain and snow. This made mining costs abnormally high, and as the mill was not operated at full capacity during the first five months of the year, the costs for mining and milling are given for two periods of five and seven months, respectively.

During the first period, 15,995 tons of ore was mined and delivered at the crusher at a cost of 65c. per ton; during the second period, 41,331 tons of ore was mined and delivered at a cost of 57c. per ton, of which 20c. represents the cost of handling waste which occurs as porphyry "horses" in the orebody.

In the spring a full head of water for removing the overburden by the hydraulic method was available for only two months. An average of 30 ft. was removed from about a half acre of ground, leaving 25 ft. to be removed to expose the ore. The ore is stated to be 40 ft. thick below this area. The ditch has since been enlarged to carry 50% more water for use in removing overburden. No addition to ore reserve was made.

During the first period of the year, 15,037 tons of ore, assaying $4.36 per ton, was treated at the mill and cyanide plant at a cost of $3.12 per ton, including development, mining and milling. The average extraction was 79%. The tonnage treated during this period was about half the capacity of the plant. During the second period, 41,331 tons of ore, assaying $4.77 per ton, was treated. The extraction was 80%. This period represents normal conditions. The costs per ton were: Development, 10c.; mining and tramming, 57c.; milling, $1; other expenses, including refining, assaying, bullion expense, power, maintenance and general charges, 52c.; total, $2.19 per ton.

It is claimed that if it were possible to obtain clean ore from the mine, it would assay $5.25 per ton, but when porphyry is being taken down, some of it becomes mixed with the ore, causing a falling off in grade. To overcome this and bring the gross value of the ore treated to the original estimate, the capacity of the mill is being gradually increased, so that the excess over the estimated 6000 tons per month will balance the increased quantity of material that must be treated on account of admixture of waste. For November, the estimate of $5.25 per ton on a basis of 6000 tons would have been $31,500; the actual ore milled contained $31,457 in gold.

The average extraction was 10% less than preliminary tests indicated. This was due to: (1) In the tests the ore was crushed to 30-mesh, producing a larger proportion of slime and fine sand than is obtained in practice when crushing through a 16-mesh screen; with finer crushing a slightly better extraction is obtained. At present it is necessary to sacrifice this extraction because extensive bodies of hard ore occur in the deposit, which reduce the stamp duty, and to crush the desired tonnage a coarser screen must be used. (2) The capacity of the agitating vats is hardly equal to the work required. (3) The slime is difficult to wash, so a considerable loss of soluble gold occurs at this stage of the treatment. (4) Early tests showed that the unreduced sulphides carried less gold per ton than the original ore. More recent tests prove that this is not true; that a large part of the 10% difference between estimated and actual recovery is due to loss of these sulphides, which, when concentrated, assay from $8 to $20 per ton.

It would not be economy to remedy the first trouble. The second is being remedied by the installation of another vat. The third will be remedied by additional filters, furnished at the expense of the patentee of the process being used. The fourth calls for concentrating tables, which will be installed; meanwhile the tailings are being stored.

The capacity of the crusher plant, as originally installed, was not satisfactory. The smaller breaker was replaced with the larger that had been used above it, and in place of the latter a 12x24-in. Blake crusher is now used. This change made the crushing plant satisfactory.

The cone classifiers below the stamps allowed too much slime to pass into the sand vats. Dorr classifiers were substituted and that difficulty was eliminated. In order to bring the plant up to estimated capacity, another sand vat, 8x30 ft., was installed, and the sides of the four original vats were raised 1½ ft. Many minor changes were also made to improve the working of the plant.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

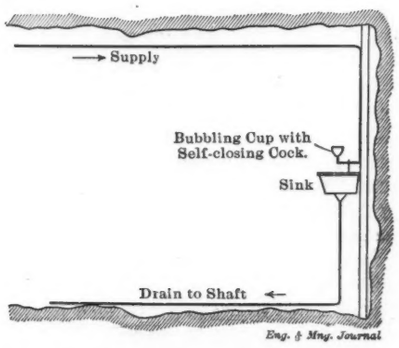
Drinking Water in the Mine

By R. B. WALLACE*

Drinking water for miners is usually carried underground in kegs and pails for distribution to the different working levels. The method is unsanitary and causes loss of time.

Recently the Republic mine, one of the properties of the Cambria Steel Co., was piped for drinking water. Galvanized iron pipe ½ in. diameter was used throughout and porcelain bubbling-cups were placed at the shaft stations of each working level. Where the pressure became excessive from depth pressure regulators were introduced in the line, also stop cocks were placed at intervals of 400 or 500 ft. along the line to shut off water in case of breakage of the pipe.

As shown in the accompanying sketch, small sinks one foot square with the drain leading to the shaft were placed under each drinking cup to carry off the water. The cup and sink are fastened to a plank wedged between the floor and roof of the station.



DRINKING FOUNTAIN IN A SHAFT STATION

*Mining engineer, Republic, Mich.

Estimating Irregular Areas

By R. H. ROWLAND*

In engineering and mining work it is often necessary to estimate areas, the outlines of which are irregular. The methods adopted consist in segregating the area into triangles, which means considerable figuring, or obtaining the result by the use of the planimeter. This instrument is not always at hand, and even with its use one seldom reads the same result after traversing the given area twice. It is my intention to describe here a rapid and accurate method of estimating areas. The method has been generally adopted wherever introduced; it has been indorsed by all who have become acquainted with it, and is so simple that it can be employed with accuracy and rapidity after little practice.

The implements employed in the operation are pencil, pricker and either a roller parallel ruler, or two triangles. Fig. 1 shows an irregular area, such as may be found in track widening in railroad excavation work. By adopting the ordinary method of dividing this area into a number of triangles in order to derive the result it will be seen that it necessitates considerable computation, whereas by eqalizing the line marked "original face of rock" and in the same manner equalizing the line marked "line of excavation," the entire area may be computed at one operation. This can be accomplished in the following manner: In any such figure it is first always essential to adopt the most convenient base line, which in this case is taken at *O G*. Prolong this line for a short distance to either side as shown, then proceed to equalize the line "original face" by placing the pricker at point *O* and the parallel rule (or triangles) in line *O* to *B*, parallel in line back to point *A* and insert the pricker in the base line. From this point in the base line move the parallel rule to point *C*, parallel back to point *B*, insert the pricker in the base line, and from this new point in the base line move the parallel rule to point *D*, parallel back to point *C*, again placing the pricker in the base line. From this point in the base line move the parallel rule to point *E*, and again parallel back to point *D*, again inserting the pricker in the base line. Then from this point in the base line move the rule to the last point *F*, again paralleling back to point *E* and inserting the pricker in base line. This gives the final point of the operation, and a line drawn from this point *X* to the point *F* is the line of equalization, viz., the portion shaded in full lines indicating the area left out, is equal to the portion shaded in dotted lines, indicating the area taken in.

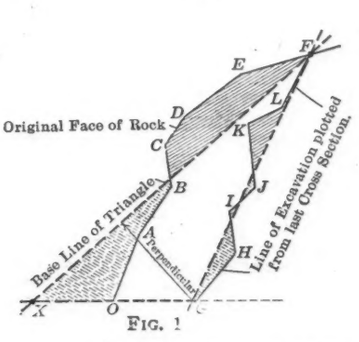


FIG. 1

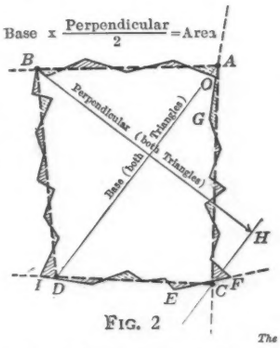


FIG. 2

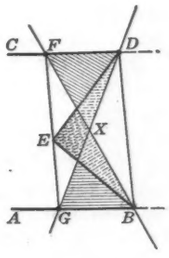


FIG. 3

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METHOD OF EQUALIZING IRREGULAR AREAS

In the same manner the line marked "line of excavation" with points *G, H, I, J, K, L, F,* can be equalized, as shown in dotted lines, thus forming one complete triangle *XGF* the area of which is easily computed.

It is essential that the pricker be held perpendicular during the operation, otherwise slight discrepancies may be found in the result; this, however, is easily accomplished with a little practice. While this operation sounds somewhat lengthy in description, it can be rapidly accomplished in practice, and the advantages of one triangle and one computation can be readily recognized.

In each case it is always advisable to check the equalization; this can be carried out in the same manner, and if the

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final point in the base line does not agree, it is owing to the fact that either the pricker has not been held in an upright position or that the points designated have not been correctly followed.

This system can be carried out for any number of points, and it is adaptable to any kind of irregular figure. As to the most convenient base to adopt, this must be determined by the computer; usually, it can be seen at a glance which is the most suitable. It will sometimes be found more convenient to adopt a square or parallelogram, owing to the shape of the figure, and in this case it would be more convenient to compute two triangles, as shown in Fig. 2.

In this figure the line *OG* is prolonged and equalized to the point *B*, obtaining line *AB;* then prolong line *EE* in same manner and equalize to point *A*, obtaining line *CA*. Using line *CA* as a base equalize to point *I*, obtaining line *CI*. Then by using *CI* as a base equalize line *IB*, obtaining line *DB*. Taking *AD* as a base line (both triangles) and *BH* as perpendicular (both triangles) the desired area is computed in one figure.

This system is also especially adaptable where it is necessary to estimate the quantities of coal or ore taken from mines, which can be directly taken from the mine plans, or from estimate tracings of them, after the surveys are plotted thereon, and with a little practice will be found invaluable, better results being obtained than with the planimeter, and, all things taken into consideration, more expeditious.

Regarding the accuracy of this method, the proof is shown in Fig. 3. Prolong the line *CD*, placing the pricker at point *D* and parallel rule in line *DB*, then parallel back to point *E*, obtaining the point *F*, line *FB* being the line of equalization. Then, in the same manner use *AB* as a base line, and obtain the point *G*, this latter being line of equalization from that base. The line *DB* will then be found to be parallel to the line *FG* which cuts through the point *E* and the area *FXG* equal to the area *DXB;* also the area *FDX* is equivalent to the area *GXB*, thus proving the accuracy of the equalization.

Testing Cage Safety Catches

It is the practice at West Australian mines to test the safety catches used on the cages at regular intervals. Attention, according to Cleland[1], is especially given to the quick response of the spring.

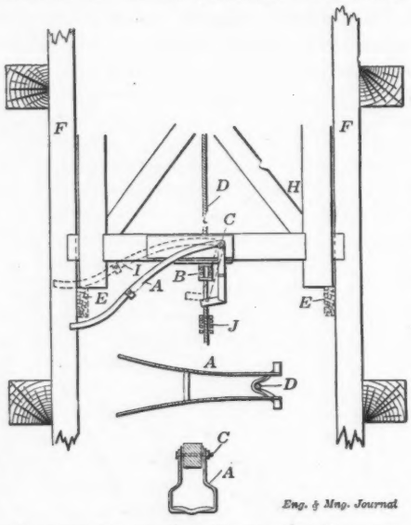
The spring is tested by loading the cage and suspending it over the mouth of the shaft, which has been covered with timber on which bags of sawdust are laid. The hoisting rope is then slackened out several feet and is fastened to the cage by a rope and slip-hook. The cage is then raised, the hook slipped, and the cage allowed to drop. If the dogs do not stop the cage before it drops 1½ or 2 in., new springs are attached and the test repeated.

[1]"West Australian Mining Practice."

Safety Crossheads for Hoisting Buckets

Because accidents have been caused by the falling of crossheads in shafts, the Canadian Bureau of Mines calls attention in its report for the year 1911, to the safety crossheads that have been designed and patented by Mr. Morin, master mechanic at the Nipissing and Mr. Sargeson master mechanic at the Waldman mine.

The object of the design of these crossheads is to prevent them from falling when they stick in the shaft. In the Sargeson crosshead, which is shown in the accompanying illustration, the attachment *A* is fastened to the crosshead at *C*. If the crosshead sticks, this



SAFETY CROSSHEAD USED AT A COBALT MINE

arm automatically engages the clip *B*, attached to the cable, and so stops the bucket. In sinking operations the arm *A* is automatically tripped by the stop block *E*, allowing the bucket to descend to the bottom of the shaft.

In the accompanying illustration, *A* shows the attachment in normal position; *I*, the attachment tripped by the crosshead stop; *B*, the clip in normal position; *J*, the clip lowered through the tripped attachment; *C*, the draw pin; *D*, the cable; *E*, the crosshead stops; *F*, the guides; and *H*, the crosshead.

The same principle is followed in the design of the Morin crosshead in the bucket follower, shown in the illustration. It is further equipped with an automatic safety device, which by the aid of springs, enables dogs to grip the guides, thus preventing the crosshead from falling.

A Four-Sided Leveling Rod

Some time ago I saw a party of engineers running a set of precise-levels using a self-reading rod, states S. P. Baird in *Engineering News*. The party consisted of instrument man, recorder, two chainmen and a rodman. Great pains were taken in setting the instrument to secure firmness, and practically all the time was consumed in setting up and in moving from one set-up to the next. Since seeing the party at work I have designed, and tried a new rod for use as a self-reading rod.

The peculiarity of the rod is not in the graduation, as any marking can be used, but in the fact that it is graduated on each of its four faces, with the zeros of the faces not coincident.

For identification purposes I have called the different faces *A, B, C* and *D*. The zero of the *A* or principal face is the bottom of the rod; the zero of the *B* face I placed 0.432 ft. above the bottom of the rod, and the zeros of the *C* and *D* faces I placed two and three times 0.432 above the bottom. For the information of the instrument man I marked the different faces at frequent intervals with the designating letter.

The use of the rod is somewhat as follows: The instrument is set up and the rod is held on the benchmark, with the *A* face presented to instrument. This side is read and recorded, then on signal to the rodman the *B* face is presented, read, and recorded, and then the same is done with the other two faces.

The readings of the *B, C* and *D* faces should be, respectively, 0.432, 0.864 and 1.096 ft. less than the reading of the *A* or principal face. Unless the readings all agree after making the proper corrections for height of zero there has been some mistake in rod reading.

The object of the arrangement is to insure accuracy in rod reading. If an error is made in reading one face it will not likely be made in reading the succeeding faces, as the cross-wire will cut the rod at points that will give entirely different sets of figures.

I have tried this rod, keeping an accurate check on the time required for the different parts of the work, and find that the time required to read the extra three faces and make the necessary subtractions for check is less than 20% of the time required to set up, read one face, and move to the next set-up. In other words, for 20% more working time I have three checks on the rod reading.

In reading of the precise-leveling done recently in Ohio I notice that it is usual to use two rodmen, each man turning on different turning points. The object of this is to secure different rod readings with the same instrument height. The method does not compare to the plan suggested above in economy or accuracy.

Landing Chair for Skips in Inclines

The usual form of chair or gate that is used in inclines for the skips to rest on consists, as shown in Fig. 1, of a strong piece of timber bolted to the ends of two arms that are equipped with a counterweight to lift the gate out of the way as soon as the skip is lifted from the chair. These gates are carried by two posts in the incline, and from the end of the arm that carries the counterweight a chain goes to the station floor by means of which the chair is raised so as to catch the skip.

The objection to this kind of chair is, that when the skip is lowered heavily on the chair or gate, the arms to which the cross piece that catches the skip is fastened are bent, as the cross piece, in order to get it out of the way of the skip when not in use, has to be carried on the end of arms at least two feet long. It therefore takes considerable time to repair this form of gate. On this account a gate the cross piece of which rests loosely in hooked carriers, which was devised by Mine Captain Samuel Richards, is used at the South Hecla shafts of the Calumet & Hecla company.

This form of gate has a three-armed spider at one end and a two-arm spider at the other. To the end of one of the three arms is connected by a hinged joint the counterweight that lifts the cross piece out of the way of the skip as soon as the skip is lifted off the gate. To the arm extending out in the opposite direction is connected by a hinged joint the hook in which is carried the cross piece that stops the skip, while to the third arm, which is at right angles to the other two, is connected the chain or rod that extends to the floor of the station, by means of which the gate is thrown in when desired. The details are shown in Fig. 2 of the accompanying illustration. Owing to the fact that the hooks that carry the cross piece are loosely connected to the arms, the cross piece as it moves up or down slides along the top side of the two posts that carry the spider. Consequently, in case a skip comes down heavily on the chair or gate, only the cross piece can be broken as it rests directly against the two posts; as the cross piece is carried loosely in the hooks, a new gate timber can be put in quickly to replace a broken one.

Chairs of this type have been in use in the South Hecla shafts for quite a little time, and now this type of gate is to become standard for all the inclines of the Calumet & Hecla company, as it has been found to be a considerable improvement over the old type having a cross timber or I-beam bolted fast to the arms, for the arms of such a gate are apt to be injured if the skip strikes it hard enough to break the cross piece or bend the I-beam.

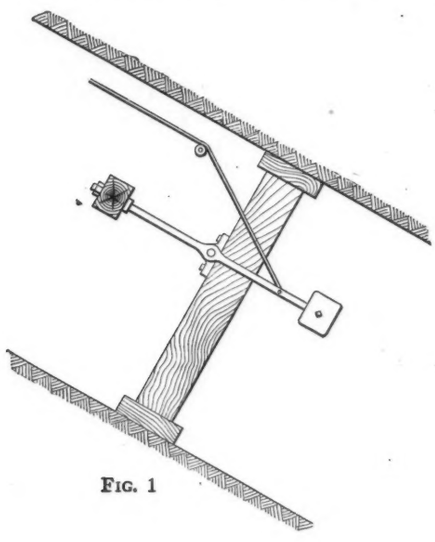


FIG. 1

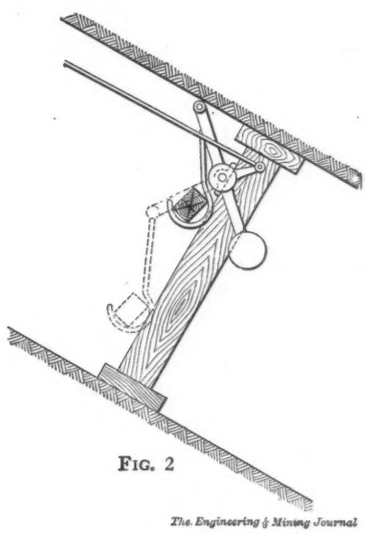


FIG. 2

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TWO TYPES OF BUFFER BARS FOR INCLINE SKIPWAYS

Copying Old Mine Plans

It occasionally happens in connection with the re-survey of an old mine, or in development work involving the examination of old plans, that copies of plans are required the originals of which are so faint and the paper on which they are drawn is so deteriorated by age that the task of copying is a most tedious or almost impossible one.

In such a case the following method was adopted some few years ago to reproduce a large and intricate mine plan which was 50 years old and a copy of which was required. This plan had been badly kept and as a result mildew and mold had played havoc with it. The ink lines were so faint and obscure that they could not be seen through the best tracing cloth or paper that could be obtained, and it therefore, at first appeared that to obtain a copy of the plan was impossible.

The method finally adopted, however, and one which was successful was to spread over the plan a sheet of transparent celluloid so that the whole plan was covered with a layer of this material. On this sheet all the details were readily traced as the sheets were absolutely transparent, by using Higgin's waterproof blue ink. The celluloid sheet was then removed from the plan and placed on white paper, and the drawing so obtained enabled a finished tracing on cloth to be made with ease.

Control of Induction Motor Hoists*

BY H. J. S. HEATHER

An interesting instance of what appears to be a misapprehension in regard to the action of the induction motor has recently come to my notice. The makers of the electrical equipment for operating a winding engine by means of an induction motor were found to have included in the gear supplied a runaway governor. This was designed to do its work by actuating through a centrifugal ball arrangement, a no-voltage release on the main circuit breaker, at the same time liberating the brake weight and causing the automatic application of the mechanical brakes. The latter part of the process was, of course, not unreasonable, but it was certainly an error of judgment to include the former one.

If it is assumed that the winding-engine gear, including the electrical part of it, is in good order, and that current, at a voltage not below normal, is available for the driver's use, the circumstances most likely to produce excessive speed of the drum are wrong manipulation of the engine or a runaway at the power station. Of these two, the first is far more probable than the second, particularly if the power plant is a large one, and it will accordingly be first dealt with.

Ordinarily a rise in speed occurring through wrong manipulation of the engine would at once be evident to the driver, and if the main circuit breaker remained "on", it would be possible for him satisfactorily to brake the motor electrically, for if a sufficiently high resistance is provided it is possible at any speed to apply electrically as a brake the maximum torque of which a motor is capable.

But even supposing the driver under the circumstance were to "lose his

*Abstract from a paper entitled "The Driving of Winding Engines by Induction Motors," read before the Institution of Electrical Engineers, May 4, 1911.

head," and to switch on current in the direction giving a forward instead of a reversed field, the speed being above synchronism he could not avoid applying electrically some braking torque, and if he paid attention to the amount of current flowing, or if this were automatically controlled, he would be able to give this braking torque its maximum value, thereby slowing down the motor to the point where he had reduced the speed to about the synchronous speed. He could not slow down below this without putting his switch lever into the proper position to give him a reversed field, but even if he failed at this point to realize this, the fact of having so far regained control would give him a better chance of avoiding an accident.

Torque-speed curves can easily be drawn to show clearly the truth of the above statement; i.e., that with an induction motor maximum braking torque is available between any runaway speed and approximately synchronous speed with the stator switch in either position, forward or reverse; the maximum braking torque is available between synchronous and zero speeds with the stator switch in reverse position only. The necessary torque-speed curves are best drawn so as to show not only both directions of motion and both directions of torque, but also the torques available under both forward and reverse fields. Whenever the torque is in the same direction as the motion, driving is taking place, but when opposed to the motion, braking is taking place.

Such torque speed curves are shown in Fig. 1 in the acompanying illustration which may be supposed to apply to the induction machine with short-circuited rotor, while the curves in Fig. 2 would hold good for the same machine with a considerable amount of resistance in the rotor circuit. In both figures speeds in percentages of synchronous speeds are plotted horizontally and torques vertically. Positive speeds are plotted to the right and negative speeds to the left of the zero speed line, and positive torques above and negative torques below the zero torque line. If the positive direction of torque is chosen to be the same as the positive direction of rotation, the torque speed curves of an induction machine acting as a motor in the positive direction will be like the curves shown in both figures in full line. Consideration of the signs makes it clear that the torque is acting as a braking torque on this machine over all speeds between infinity in the negative direction and zero, and again over all speeds between 100% and infinity in the positive direction. The machine is a motor only between zero speed and 100% positive speed.

The behavior of the same machine with its field so excited that it runs as a motor in the negative direction is shown by the dotted curves in the two figures. With the machine so excited a braking torque is exercised at all speeds between infinity and 100% in the negative direction, and again at all speeds between zero and infinity in the positive direction. The machine thus excited is a motor only between zero speed and 100% negative speed. In whichever direction therefore the field is excited a braking torque must be produced at all speeds higher than 100% in either the positive or the negative direction, that is at all runaway speeds.

To guard against a runaway due to wrong manipulation on the driver's part, it is consequently bad practice to make a runaway governor open the main

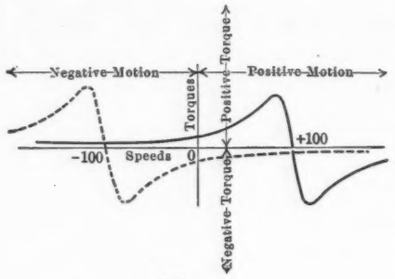

FIG. 1

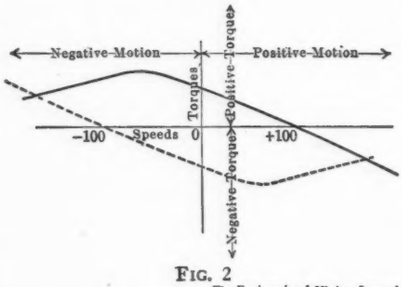

FIG. 2

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INDUCTION MOTOR HOIST TORQUE-SPEED CURVES

circuit-breaker, as such an arrangement eliminates a most valuable control.

The less probable case, that in which the running away of a winding engine driven by an induction motor is due to a runaway at the power station, remains to be considered. It will be seen that under these circumstances the use of such a governor is equally wrong.

If this sort of runaway happened when a load was being lifted, no danger would be likely to arise before the driver had time to notice the increase in speed, and to check it by inserting resistance, unless the runaway were to take place near the end of a wind, at which moment the driver would normally be on the alert to apply brakes and reverse current, and the automatic elimination of the possibility of using reverse current would certainly not then make for safety.

If, on the other hand, the runaway at the power station happened when a load was being lowered, two cases have to be considered. The operation of lowering might be taking place in either of two ways: the motor might be in use regeneratively or with reverse current. A driver of a hoist working regeneratively would be in the habit of using reverse current for braking at the end of the trip, and if he found that his motor was running faster than usual it is unlikely that he would do anything but apply reverse current somewhat earlier or somewhat harder than under ordinary circumstances. The action of the governor in taking electrical control out of his hands would be extremely likely to cause a catastrophe.

In the second case, in which the driver is supposed to be lowering according to custom with reverse current, it is unlikely that excessive speed at the power station would cause the skip to run away, as the driver in keeping the current at its normal value, would probably use a somewhat higher resistance than usual without noticing that he was doing so, or without being aware of the fact that anything abnormal was going on. If, however, a runaway did occur, the governor by taking away the means of control he was using at the time, even though it automatically substituted the mechanical brakes, could only increase the risk of accident.

In connection with the whole question of momentarily excessive or reduced speed at the power station, an interesting point may be mentioned. On the supposition that for a few seconds the voltage would vary proportionally to the frequency (and this would be the case in practice) my proposal to use an ammeter in either the rotor or the stator circuit to prevent the winding-engine driver from losing electrical control by using a current greater than that corresponding to maximum torque, affords a reliable guide even under these emergency conditions. The current at which maximum torque would be reached would remain the same though the torque itself would vary. This statement is exactly correct in the case of the rotor circuit and approximately so for that of the stator, but the proof, being extremely simple, need not be given here.

In no case, therefore, would the automatic cutting off of current be likely to do any good; under most circumstances it would increase the risk of serious accident.

My own view is that no-voltage releases should be set low; that overload releases should be regarded only as a means of preventing further damage to a broken-down machine; and that a runaway governor should only apply the mechanical brakes, and should certainly not cut off the electrical supply.

Details of Metallurgical Practice

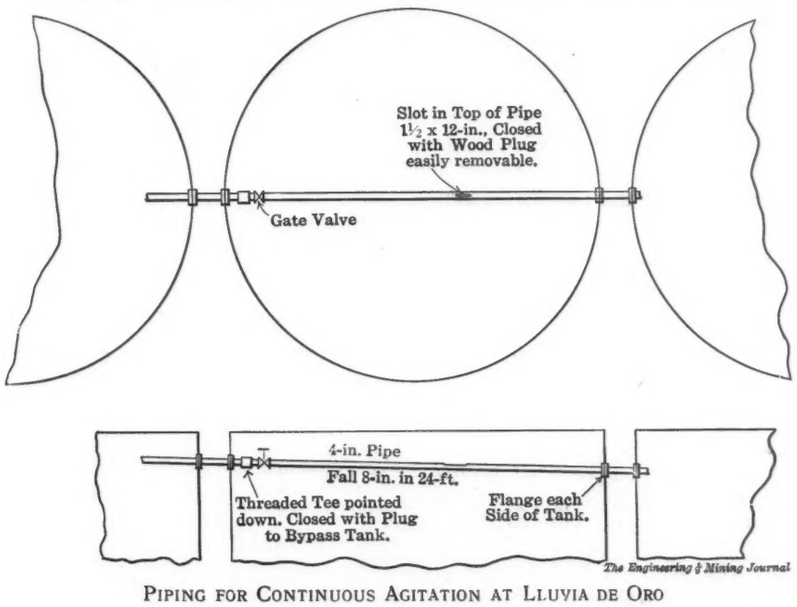
Records of Experience in Ore Dressing, Cyaniding and Smelting

Piping for Continuous Agitation

By H. R. Conklin*

I devised the layout of piping for continuous agitation, herein described, having in view the simplest satisfactory design. Five tanks, each 24 ft. in diameter and 32 ft. deep, with conical bottoms, were to be piped for continuous agitation, without interrupting their use for intermittent agitation, with settling and decantation.

A straight line of 4-in. pipe, with grade of 8 in. in 24 ft., was put through all five tanks, the first tank having the pipe at entrance resting on its top and at exit, 8 in. below the top. The fifth tank has the pipe at exit 40 in. below the top. The work on the tanks consisted in cutting two 4-in. holes in each tank at proper elevations and boring holes for flange bolts. Connections through the sides of the tanks were made by flanges on each side of the tank sheet using gaskets of old rubber belting. On the pipe in each tank, a threaded tee, pointing down, was placed about 5 in. from the entrance side of the tank for discharging the pulp into the tank. A gate valve was placed next to prevent any pulp from passing along the transfer pipe.



Piping for Continuous Agitation at Lluvia de Oro

The pulp is discharged from the tank through a slot in top of the transfer pipe, about 1½ in. wide and 12 in. long. This slot is closed by a hard-wood plug, fitted with a handle of suitable length so that it can be pushed into place from the platform on top of the tanks. This wood plug should not project far inside of the pipe, as it would hinder the flow of pulp in the pipe. The downward-pointing tees are closed, when so desired, by pipe plugs screwed in. These 4-inch pipe plugs, and the wooden plugs are both attached to the tank platform by loose chains, to prevent workmen dropping them into the tanks. To bypass any tank, it is simply necessary to screw in the pipe plug, open the gate valve and plug the discharge slot. Air agitation produces sufficient elevation of the pulp in the middle of the tank to cause a continuous sampling out through the discharge slot, while a continuous supply enters through the threaded tee. The level of the pulp in the tank takes care of itself. Any tank can be bypassed and pumped out for repairs or other reason, and no difficulty is experienced in bypassing three or four tanks at the same time. The transfer pipe can be easily cleaned of any settled pulp by air or water hose passed through any of the slotted discharges. By placing both plugs in any tank, thus bypassing it, it can be used for agitation and decanting, if desired, and the change from one system to the other causes no delay.

*Superintendent, Lluvia de Oro Gold Mining Co., Lluvia de Oro, Chihuahua, Mex.

Volumes of Prismoidal Tanks

For computing partial volumes of rectangular tanks or reservoirs having sloping sides, Douglas McLean, Coolgardie, West Australia, recommends, according to *Engineering News*, the method of constant second differences. Dividing the tank into zones or layers of equal height, the difference between the contents of one zone and the contents of the zone next below is the first difference; the difference between two successive first differences is the second difference. The second difference is constant for a tank of the shape mentioned. To apply this fact, calculate the volume of three successive zones, find the first differences and the second difference, and add the latter successively to the first differences, thus obtaining all the first differences. The latter, added to the volumes that have already been calculated, will give all the zone volumes.

A little calculation will be saved by using the formula for the second difference:

$$D'' = 8\,mnh^3$$

in which h is the depth of the zone, m is the ratio $\frac{\text{horizontal}}{\text{vertical}}$ for the side slopes, and n is the corresponding ratio for the end slopes.

Example—Rectangular reservoir with side and end slopes 1 on 2; bottom dimensions 286 by 135 ft.; depth 14 ft.; find the contents of zones 6 in. deep.

Here $m = n = 2$, and $h = ½$, so that $D'' = 8 \times 4 \times ⅛ = 4$ cu.ft. Computing the volumes of the two lowest zones, we get 19,516.17 and 19,941.17, with a first difference of 425. Then the successive first differences are 425, 429, 433, 437, etc. The volumes are then found.

Zone	Second diff.	First diff.	Volumes
0 — ½	4.00	....	19,516.17
½—1	constant	425	19,941.17
1 —1½	constant	429	20,370.17
1½—2	constant	433	20,803.17
2 —2½	constant	437	21,240.17
2½—3	constant	441	21,681.17

Precisely the same method of calculation applies to conical tanks, *i.e.*, circular tanks with sloping sides, except that the second-difference formula is slightly different. Calling m the side slope $\frac{\text{horizontal}}{\text{vertical}}$ and h the depth of zone, the formula is

$$D'' = 2\pi m^2h^3 = 6.283\,m^2h^3$$

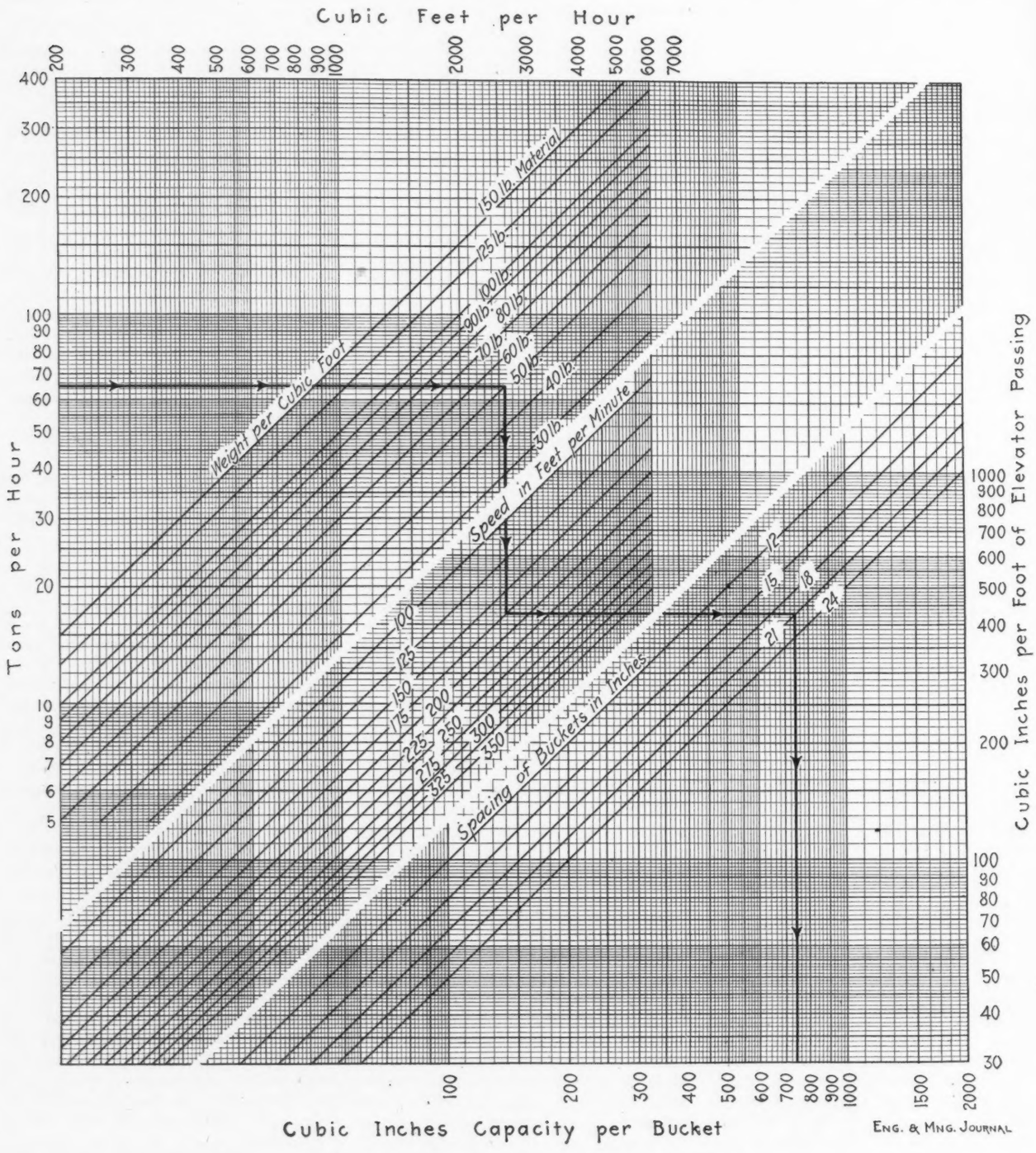
which is constant.

Bucket Elevator Chart

The accompanying chart shows at a glance, practically all the data necessary to determine the speed, capacity and size of bucket elevators, according to the practice of the Robins Conveying Belt Co., of New York. In using the table it should be borne in mind that the required bucket capacity found in the diagram is the working capacity, and somewhat larger buckets should be used, depending on conditions. It is common practice to assume the working capacities of Salem buckets as two-thirds to three-quarters of total capacity when they are operated on a vertical belt.

The heavy line gives the solution for 65 tons of coal per hour, at a speed of 175 ft. per min., and a spacing of 21 in., showing required working capacity of 740 cubic inches.

To find the horsepower required for driving a vertical bucket elevator, multiply tons per hour by lift in feet and divide by 500. This allows for 100% friction.



CAPACITY AND SPEED CHART FOR BUCKET ELEVATORS

To find the proper size of a bucket elevator for a given tonnage or volume of material per hour and given weight per cubic foot, enter chart at left with tons per hour and follow across to diagonal line showing weight per cubic foot, thence down to diagonal line representing the desired speed of elevator, thence across to the right until the diagonal showing desired spacing of buckets is reached. At the bottom, directly below this intersection, is found the required capacity of bucket in cubic inches. If the hourly capacity is given in cubic feet, enter at the top of the chart and follow down until the desired speed line is found, thence across to spacing, etc., as before.

The Homestake Mining Co.

The latest report of the Homestake Mining Co., operating in the Black Hills of South Dakota, covers two periods, the year ended June 1, 1911, and an iterim period from June 1 to Dec. 31, 1911. Hereafter the fiscal year will be the calendar year.

The costs for the two periods, bullion yield, etc., are shown in the accompanying table, which we have prepared from the statements of receipts and expenditures published in the company's report; in that report no cost-per-ton figures are given. The item net sundry expense includes shop and foundry, general, and all other expenses that the report does not clearly distribute. During each period the company received about $123,000 in return for castings, wood, timber, other sales and interest. This amount was deducted from the item "net sundry expense" before the figures of that item were placed in the table. From the nature of those receipts it seems proper to regard them in this way. During the first period 1,468,263 tons of ore were milled and 888,057 in the second.

COSTS AT THE HOMESTAKE MINE

	June 1, 1910 to June 1, 1911		June 1, 1911 to Dec. 31, 1911	
	Amount	Per Ton	Amount	Per Ton
Assaying	$32,164	$0.0219	$12,237	$0.0137
Surveying	24,364	0.0165	16,441	0.0185
Mining	2,726,622	1.8570	1,529,939	1.7219
Milling	410,651	0.2797	244,857	0.2756
Regrinding	20,884	0.0142	12,273	0.0138
Cyaniding sand	204,099	0.1390	108,463	0.1219
Cyaniding slime	155,098	0.1056	95,359	0.1073
Net sundry expense	371,621	0.2534	231,788	0.2608
Total costs	$3,945,503	$2.6873	$2,251,357	$2.5335
Spearfish hydroelectric power plant	393,088	.....	231,134	.....
Dividends	1,310,400	.....	764,400	.....
Surplus for period	—397,537	.....	414,261	.....
Bullion return	$5,251,454	$3.5766	$3,661,152	$4.1205

On the assumptions that 5% of the ore milled is reground, that 60% is leached as sand and 40% treated as slime, regrinding costs 28c., cyaniding sand 22c., and slime treatment 27c. per ton of material actually treated.

The broken ore in the stopes on Jan. 1, 1912, was 1,883,277 tons, and it is estimated that enough ore is blocked out to supply the 1000 stamps for 20 years. Water was turned into the hydro-electric plant at Spearfish early this month and on Mar. 15, 1912, the full available head was turned into the ditch and through the tunnel. The generating station, pipe lines, etc., were given a thorough test.

The oil-tank steamer "Rosecrans," owned by the Associated Oil Co., was wrecked on the rocks off Alcatraz, San Barbara County, Calif., on the morning of Mar. 12. The "Rosecrans" was 320 ft. long and of 25,000 bbl. capacity.

Phelps, Dodge & Co.

The report of Phelps, Dodge & Co. for the year 1911 shows a total production of 134,149,627 lb. of copper by its smelteries, of which 123,653,978 lb. was from its own ores. The Copper Queen works produced 111,445,229 lb. of copper, and the Detroit Copper Mining Co.'s smeltery, 22,704,398. During the year 158,900,257 lb. of electrolytic copper and 21,401,708 of casting ingots were sold, the latter being made from the Detroit pig. The average price received for the copper was 12.36c. per lb., net cash, f.o.b. New York. The Copper Queen plant produced 1,794,895 oz. of silver, and 27,154 oz. of gold.

The total ore extracted from the company mines was 1,841,210 tons. The concentrators treated 1,017,352 tons, producing 179,234 tons of concentrates (5.7:1). The smelteries treated 930,331 tons of new copper-bearing material, of which 822,647 was company ore, while some lead-bearing ores were shipped to the El Paso smeltery, and some sulphides to the Old Dominion works.

Copper Queen Mines

At the Copper Queen mines, 62,150 ft. of development work was done during the year, and 884 ft. of diamond-drill holes put down. The discovery has been made in the Spray mine of a series of layers of sulphide ore in the Abrigo limestones of the Cambrian age, encouraging the hope that older rocks than the Upper Devonian and Lower Carboniferous may carry commercial deposits. The only great change in mining methods has been the substitution of smaller stulls and closer filling for the old heavy square timbers. This has resulted in lowering timber consumption per ton of ore extracted as follows: Stoping, 20.1 ft. in 1910 to 16.6 ft. in 1911; exploration and development, 4.2 to 3.9 ft.; surface repairs and construction, 0.3 to 0.1; while underground repairs rose from 2.3 to 2.7 ft. The total fell from 26.9 to 23.3 ft. Eight and one-half miles of electric haulage is now in operation, and it is found that the average tramming distances are as follows: By hand, 229 ft. per car of ore; mule, 646; electric locomotive, 2669 feet.

The operation of the Copper Queen central power plant has been efficient. The actual evaporation has been 12.78 lb. water per lb. oil, and evaporation from and at 212°, 15.64 lb. The plant consumes 6,450.5 gal. of oil per day, generates 629,751 lb. steam, 323.4 kw. per hr. of 2300-volt, three-phase alternating current, and compresses 6127 cu.ft. of air per minute.

The Copper Queen smeltery treated 1,135,646 tons of charge, exclusive of coke, of which 854,463 tons were ore. The coke consumed was 128,923 tons. The flue-dust recovery was 6.55% of the charge treated. The copper, silver and gold in the flue dust as compared with the recovery of these metals were 14.3, 12.8 and 7.7%, respectively. The matte fall was 24.94%, with a 36.7% tenor.

In the converting department a new flue was built, removing the converter gases from the main dust chambers. The converters are still lined with siliceous ore and slimes, about 25 tons of bullion being produced per day from a 36.7% matte. A license has been obtained from the Peirce-Smith Converter Co. to use the basic lining, and George B. Lee recommends adopting the Great Falls type of converter, but in the meantime putting basic lining into some of the present shells.

Molten converter slag is mixed with flue dust in a truncated revolving cone. The slag absorbs about 25% of dust, and is effectively balled by this process.

Detroit Copper Co.

At the Detroit works 517,087 tons of ore treated gave 22,704,398 lb. bullion, as against 494,286 tons of ore, which yielded 23,056,292 lb. bullion, in 1910. Up to 1907, square setting only was practiced in the Detroit mines; the accompanying table shows the work done since that time. While general exploratory work has not been encouraging during the year, ore has been found on lower horizons than it was previously known to exist.

COMPARISON OF MINING SYSTEMS AT MORENCI, ARIZ.

	Tons Ore Extracted	Per Cent. Total	Comparative Cost	Timber per Ton Ore
Slicing	460,340	90.55	81.6%	9.03
Block caving	13,909	2.74	54.8%	1.85
Square set and fill	21,283	4.19	100.0%	10.19
Underhand square set and back fill	11,061	2.17	127.1%	14.99
Gopher and fill	1,762	0.35	51.7%	1.8
	508,355	100.00	.....	8.985

The concentrator gave a saving of 73.05%, putting 7.57 tons into 1, the ore carrying 2.869% Cu, the concentrates 15.876%. The tailings assayed 0.848% Cu, and the water used amounted to 522.6

gal. per ton of ore milled. The blast furnaces and converters made a saving of 92.608%, although less than 49% of the charge was new copper-bearing material.

In the Moctezuma mines, in Sonora, 13,668½ ft. of development work was done, of which 4466 ft. was purely prospecting work. The mines delivered 524,336 tons of ore and increased the reserves of broken ore by 181,000 tons, making a total reserve of broken ore ready for drawing of 302,000 tons. A scheme has been adopted which will allow the mine pillars to be taken hereafter at the same time that adjacent ground is being stoped. During the year recovery of ore from the cave-in of several years ago was commenced, 14,000 tons being thus recovered.

The Moctezuma concentrator treated 517,352 tons of 3.1708% ore, and produced 113,222 tons of 11.932% concentrates (4.569: 1), the saving amounting to 85.19%, and the tailings assay being 0.5579%. As far as possible, Mexican foremen have been substituted for the Europeans.

Stag Cañon Company

The production of the Stag Cañon Fuel Co. for the year was 1,148,471 tons, a decrease of 232,986 tons, as compared with 1910, used as follows: For steam raising at mines, 1443 tons; sold to employees, 4203; sold to railroads, 448,625; commercial sales, 120,801; used for coking, 573,399 tons. There were three fatalities, making 382,823 tons of coal mined per life lost. The product of the mines is marketed through the Vermejo Coal & Coke Co., a newly organized subsidiary of the Stag Cañon company.

The general stores business, hitherto conducted by these subsidiaries, has been taken over by the Phelps-Dodge Mercantile Co., which pays a rental to the mining companies for the store buildings. The total sales of merchandise were $5,317,994, on which a profit of 7.51% was made.

Owing to the rulings of the Treasury Department in regard to the Corporation Excise Tax Law, permitting depreciation to be written off on mining properties, the book values of the various company mines have been written up during the year as follows: Copper Queen, from $500,286 to $13,967,242; Detroit, $585,984 to $2,821,569; Moctezuma, $992,771 to $3,846,202; Stag Cañon, $500,000 to $3,479,032. The Copper Queen had net earnings of $4,155,011 for the year, before allowing for depreciation, and paid $5,200,000 dividends; the Detroit earned $930,496, before allowing $267,709 depreciation, and paid $800,000 dividends; Moctezuma earned $1,206,183 before allowing $655,506 depreciation, and paid $754,000 dividends; Stag Cañon earned $345,071 before allowing depreciation of $56,498, and paid dividends of $240,000. It appears, therefore, that with the exception of Stag Cañon, the surplus accounts of all the subsidiaries would have decreased had it not been for the additional mines values written in.

Notes on Porcupine

By H. Y. Russell*

While there has been a lull in the boom in Porcupine stocks work on several properties in the district has gone steadily ahead since the fire in July, and earnest and well directed efforts are being made to prove the orebodies. Shafts have been sunk deeper, deeper drilling has been done and much additional information has been gained. While the information gained has not been sufficient to establish many hard and fast facts, it enables one to guess a little better than before, and a few notes made in Porcupine last year might be of interest.

The following observations may be said to include the townships of Tisdale, Deloro and parts of Shaw and Whitney.

Two Vein Systems

Speaking generally I think it may be said that the strike of the country rocks, which are mostly schists and diabases, is from east and west to about N. 70 E. Mag.; also that there are two what might be called vein systems, one running with the strike of the schists, and the other striking from N. 45° E. to almost North.

In these vein systems the quartz appears to be in lenses of varying lengths and widths. So far depths have not been determined. Surface examination shows that in a general way the lenses in the easterly and westerly system are longer and more continuous than those in the second system. They are frequently from 500 to 700 ft. long and from 2 to 8 ft. wide. In one particular case one of these lenses had been stripped for a distance of about 700 ft. gradually pinching at each end. Following on the strike of this lens another was exposed 700 or 800 ft. further on; 1000 ft. farther was another lens, and 300 ft. farther a lens longer and wider than the first was seen.

The quartz in these lenses is similar and acts in the same way gradually pinching to a small seam and then disappearing. In a number of places between these lenses the ground was low and wet and it was impossible to trench, so there may have been other lenses between those observed.

The lenses of the second or more northerly system appear to have a length of from 100 to 250 ft. and widths of from 2 to 20 ft., but do not seem to be by any means so continuous horizontally as the lenses of the easterly and westerly system. Several lenses, however, may be found in the one zone, when they lie east or west of each other, separated often by considerable distances of country rock, but having the same northerly strike.

Gold Occurs in the Quartz Lenses

The only valuable metal in the veins is gold which occurs in the quartz lenses. In places good assays are obtained from the schists adjoining the quartz, but a close examination of the schist will usually show minute stringers or nodules of quartz and it is with these that the gold seems associated. Iron pyrites is found in stringers and crystals through the quartz and adjoining country rock of both systems but the iron in the easterly system seems coarser than that in the northerly system. Visible gold is frequently found along these iron stringers.

The trend of development so far seems to show that the easterly veins are low grade; specks of visible gold are seen but few if any bodies of pay ore have been reported.

The northerly lenses are often exceedingly rich, some of the gold showings being most spectacular. The gold is not confined to specimens but distributed over the whole width of the lens in many places. Gold is also found in the schist walls where small quartz stringers are seen.

On account of the tremendous glaciation the district has undergone it seems reasonable to suppose, that if gold is not found on, or very close to, surface, it is unlikely to be discovered at depth. Surface showings can however be expected to continue to considerable depths so long as the quartz goes down, and the published reports of drilling to depths of 800 and 900 ft. would confirm the belief that the quartz is continuous vertically.

I have not seen a case of the veins of the two series crossing although in places they are fairly close together, either one or the other pinching before a junction is reached.

Several shafts are down over 200 ft. and the orebodies hold their size and value to that depth. Should the orebodies go to considerable depth they would of course be more properly called shoots, and it is to decide the question of shoots or lenses that the real work of Porcupine is being directed.

*Mining engineer, 423 Guy St., Montreal, Canada.

Senator Nixon has offered a bill at Washington, providing that all public lands containing borax shall hereafter be subject to location as placer deposits.

Blast Desiccation by Calcium Chloride

By J. B. Van Brussel*

Iron-furnace blast dried by calcium chloride, which is kept cool by water pipes embedded in it. The hydrated calcium chloride is then in turn desiccated by a mixture of furnace gas and air.

*P. O. Box 151, Brussels, Belgium.

The desiccation of the air required for blast furnaces unquestionably affects a great economy in fuel, and up to the present, numerous attempts have been made to devise practical and cheap methods of air desiccation. Quite recently, the Differdange Iron & Steel Works, in Luxemburg, has made trials of a process invented by two French engineers, Felix A. Daubine and Eugene V. Roy, based on the employment of calcium chloride. The results obtained at Differdange were communicated by the inventors to the Iron and Steel Institute at the last meeting of that great association of English metallurgists.

Highly concentrated solutions of low vapor tensions are hygroscopic, being capable of extracting, up to a certain state of equilibrium, the moisture contained in gases possessing higher vapor tensions than those of the solutions in question. The more rapidly equilibrium is attained, the more suitable is the substance for playing its part as a desiccating agent. Calcium chloride is a good desiccating agent that can be conveniently and economically regenerated.

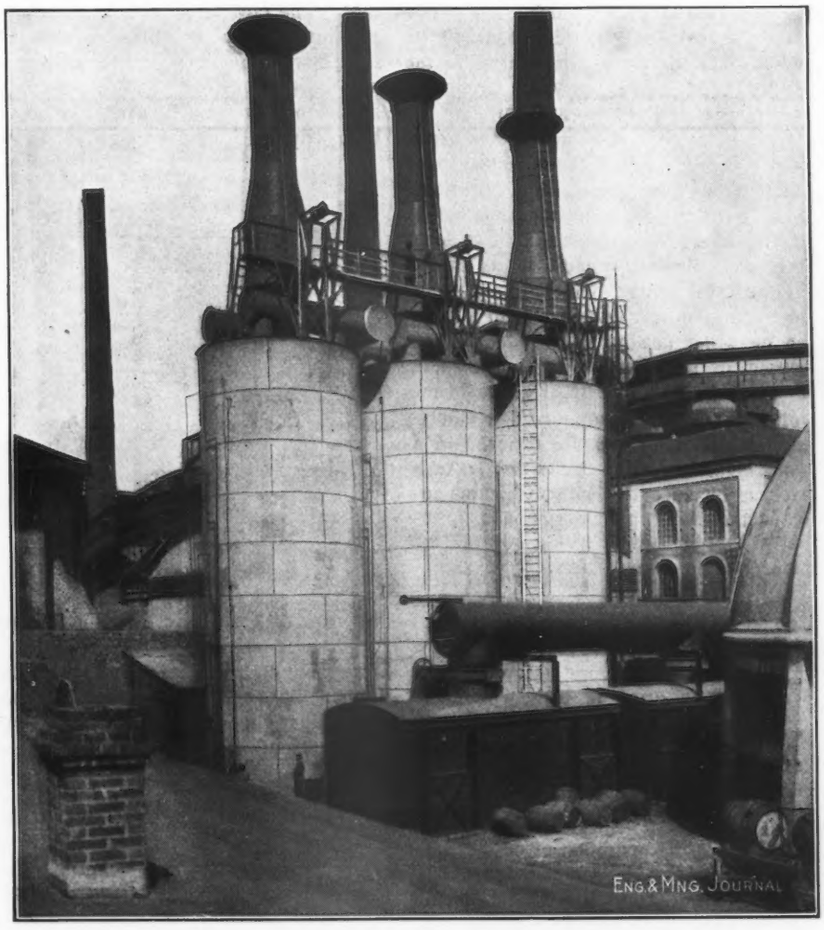
Briefly, the details of the process are as follows:

Calcium Chloride Must be Cooled

A layer of broken calcium chloride, the smaller pieces at the bottom and the larger pieces at the top, rests on a sieve. Within the mass of the calcium chloride, in its lower part, is submerged a spiral grating, consisting of pipes for the circulation of water. The volume of air to be dried is made to traverse the mass of calcium chloride from top to bottom, the draft being created by a fan. The absorption of the water by the calcium chloride leads to an evolution of heat, and this heat is carried away simultaneously with its production by the water circulation within the spiral. Without this indispensable precaution, the temperature of the mass of calcium chloride would rise, the tension of its hydrates would rise likewise, and the chloride mass would cease to act efficiently.

The hydration of the calcium chloride should be arrested when the outside pellicle of the broken pieces commences to liquate. If it were continued, the mass of calcium chloride would be completely liquefied, and it would be impossible to regenerate it on the spot. Further, the fact of its being liquefied indicates that the calcium chloride has formed a hydrate whose dilution is already considerable and that, as a result, its vapor tensions render it unfit for effective desiccation. At this point, it becomes time to regenerate and to do this it is only necessary to attain the temperatures between which that hydrate best known for this purpose is formed, namely $CaCl_2 + 1H_2O$, which is produced between 175 and 235° C. During the progress of this regeneration, it is necessary gradually to raise the temperature in such a manner as constantly to maintain the hydrates in their solid phase.

Suppose, for instance, that after the passage of the air to be dried, the formula of the exterior hydrates is, at a given moment $CaCl_2 + 4\,H_2O$, a hydrate which melts at about 40° C. Owing to the circulation of the water, which has maintained the temperature of 15° C, this hydrate has remained solid; if, at the moment of regeneration, the temperature be suddenly raised, to above 40° C. the pellicle corresponding to the above formula melts, breaks down, and is wasted. It is necessary, therefore, to proceed progressively, according to the law which has been recognized in practice, and may be deduced from theory, from the curve of the liquid and solid phases of the different hydrates of calcium chloride. It is necessary also, in the course of this regeneration, to be careful not to exceed the temperature of 235° C. The regeneration of the calcium chloride is thus to be effected with sources of heat of comparatively low grade, and it is possible to employ, with this object, the waste gases which occur plentifully in all iron and steel works. The regeneration of the calcium chloride having been effected by this systematic warming, it is necessary, in order to render it again fit for the complete absorption of water vapor, to cool it completely. This cool-



Calcium Chloride Desiccating Towers, Differdange Works

ing is quickly attained by a rapid circulation of water in the pipe system, and when the average temperature of the water is regained, the chloride of calcium again has all its hygroscopic properties, and is capable of desiccating afresh the new volumes of air.

The experiments at the Differdange Iron & Steel Works were made with a blast furnace producing 150 tons of pig per day, and requiring a blast of about 1,000,000 cu.ft. per hr. The installation put down is shown in the accompanying half tone. It consists essentially of three high towers, the interior construction of which is also shown.

Each tower is divided into 10 stories or compartments, each of which contains a ring-shaped gate, which supports a layer of calcium chloride about 10 in. deep. The air to be dried enters at the bottom and passes upward through a central conduit, downward through the layers of calcium chloride and the grate, and upward through the annular space surrounding the grates and partitions, until it reaches a collecting chamber at the top of the tower, whence it flows down through a lateral conduit to its outlet, at the level of the fifth story. During this operation, each compartment is cooled by water flowing in a coil of pipes, buried in the mass of chloride above the grates. This pipe is arranged in the form of a cone to insure complete emptying, and all its joints are inclosed in a water-tight box from which all leakage escapes by an outlet without coming into contact with the chloride and forming a solution which would corrode the pipe and the grate.

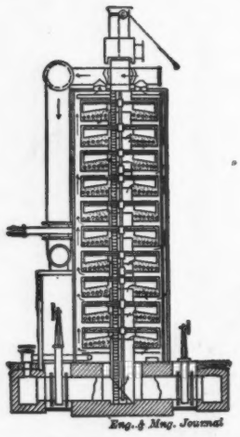
Extra Towers Necessary During Regeneration

After six or eight hours' use, the stream of air to be dried is turned into the second tower, and the chloride in the first tower is regenerated by a current of hot furnace gas tempered by admixture with air. This current in general follows a course contrary to that taken by the air in the operation of desiccation. The regeneration is completed and the chloride restored to its initial condition in about four hours. The hot gas is then shut off and the hot regenerated chloride is cooled by a current of water flowing through the coils which serve to keep the mass cool in the drying operation.

Blast-furnace gas often contains so much dust that the chloride would become unfit for use after a few regenerations. The original idea of the investors was to confine the hot gas to a system of pipes buried in the layers of chloride, and thus to accomplish the regeneration by conduction, and not by direct contact. It was deemed unnecessary to introduce this complication at Differdange, where a sufficient quantity of gas containing little dust could be obtained.

The fact of having three towers explains itself. While one is being used for desiccation, the second is employed in regenerating the used chloride, and the third is cooling in order to fit it for resuming the work for desiccation. In winter, when the humidity of the air decreases, the simultaneous use of two towers would probably suffice.

The charge of chloride in each tower at Differdange was 24 tons, the cross section of the air or gas current about 1100 sq.ft., the refrigerating surface for the water pipes about 1800 sq.ft. The installation was calculated for the most unfavorable condition presented in summer. The cost of the whole installation amounted to about $10,000. Only one man is required to watch the operations and move the valves. The calcium-chloride method, it must be said, has not yet been employed long enough to demonstrate fully its advantages and its general applicability, but it is now quite established that the manufacture of dry air need present no difficulty whatever.



Section of Calcium Chloride Tower

West Australian 1910 Mineral Production

According to the official report, just received, the value of the West Australian mineral production for 1910 was £6,522,263, a decrease of £536,816 from 1909, the value of the gold mined shrinking £529,426. The production was made up as follows: Gold, 1,470,632 oz.; silver, 176,139 oz.; coal, 262,166 tons, £113,699; copper, 6309 tons ore, 1281 tons matte and metal, £95,928; tin, ore and ingot, 500 tons, £45,129; all else £1882. To obtain the gold production of 1,470,632 oz., 2,884,298 tons of ore were treated, the average working costs per ton being $4.88, and the average tenor, $10.15. East Coolgardie was responsible for 57.05% of the total production, and employed 5729 men. Yilgarn, containing the Bullfinch mine produced 2.11% of the total. The state erected a new stamp battery at Marble Bar, Pilbara, which is expected to help that field.

Stanley Steel Investigation

Washington Correspondence

Probably the last witness before the Stanley Steel Investigating Committee will be an engineer of national reputation who will be called to testify with reference to the probable reasons for the breaking of steel rails on railroads which has been such a prolific cause of accident within the last few months. The intention now is to put this man in the witness stand within a week and to question him closely as to the methods of manufacture in the steel mills. It will be attempted to have him state how rapid is the process of manufacture and how far the use of quick methods may be considered responsible for the defects which have been found in the present type of rails.

The committee intends to let a substantial part of its report deal with the whole question of efficiency in the steel industry as affected by the present type of organization under the United States Steel Corporation. There is a strong feeling that the grade of products, as exemplified in the case of defective rails, has been allowed to deteriorate within recent years.

Iron Blast Furnace Changes

The American Iron & Steel Association reports that in 1911 there were eight entirely new blast furnaces built in the United States, all coke, with an annual capacity of 1,152,500 gross tons. Three of the furnaces, with an annual capacity of 437,500 tons, had not been blown in by Jan. 1, 1912. Of the total new furnaces, five, with an annual capacity of 675,000 tons, were in Pennsylvania, and three, with an annual capacity of 477,500 tons, were in Ohio.

On Dec. 31, 1911. there were one charcoal and 12 coke blast furnaces in course of erection in the United States, with a total annual capacity of 1,744,500 tons, of which 20,000 tons were charcoal and 1,724,500 tons were coke. One or two of the coke furnaces have been completed and blown in since the opening of the present year; others are to be completed later in the year; while still others may not be ready for blast before the end of the year.

During 1911 there were 20 blast furnacces abandoned or dismantled in the United States, with a total annual capacity of 404,700 gross tons. Of the total seven furnaces, with an annual capacity of 60,700 tons, used charcoal for fuel when last in blast, and 13 furnaces, with an annual capacity of 334,000 tons, used mineral fuel.

The Beginnings of Physical Chemistry

By Harry C. Jones *

Many metallurgical processes depend on physical chemistry, and many future developments appear to hang on its advancement. This, the first of a series of articles on the subject, takes up some of the great generalizations and their discoverers.

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These are interesting days in which to live, both from the standpoint of pure and of applied science. The developments of the last 25 years mark a new epoch, not only in the discovery of facts, but what is vastly more important, in the bringing to light of generalizations which correlate and coördinate these facts.

The result is that a fundamental and in some cases almost a revolutionary change has taken place during this period in a number of branches of natural science. Of the various branches to be affected perhaps none has undergone such serious changes as chemistry; yet the generalizations in question have been so wide reaching as to make their influence felt in almost every quarter where nature is studied.

The Newer Concepts

The chemistry of atoms and molecules is now hardly more than of historical interest. The importance of solution is just beginning to be recognized. The effect of mass or quantity in chemistry has only recently come into its own, and the stable chemical atom of the last century is gone forever. We are just beginning to learn what is meant by chemical valence, and quantitative analysis has taken on a new aspect since we have learned the meaning of precipitation, and since electrolytic methods have been so generally worked out for effecting the separation of the metals from one another.

The industries have been scarcely less affected than pure science. Compare the methods today for obtaining the pure metals with those of a quarter of a century ago, and the meaning of this statement will become clear. Or study the advances during this period in the conversion of intrinsic energy into electricity. Or again, the progress that has been made in the so called "fixation" of nitrogen, i.e., the conversion of the free nitrogen of the air into compounds that are available for plant life and growth.

These facts are probably as well known to the live engineer as to the man of pure science. It is scarcely an exaggeration to say that a new science and a new industry have come into existence during this period. It is, however, not quite certain how general the knowledge is, as to how this all has come about, and through whose energy it has been accomplished.

Rise of Modern Physical Chemistry

The progress in question has centered around what is generally termed the modern or new physical chemistry. The term physical chemistry is unfortunate, since it may leave the impression that we are dealing here with something that is fundamentally different from chemistry, while such is not the fact. We are dealing, as we shall see, only with the broadest and best that chemistry has thus far afforded—with really scientific chemistry. Again, the term physical chemistry is unfortunate, because we have had physical chemistry for nearly a century, but the new physical chemistry differs from the old not in degree, but absolutely in kind. The term physical chemistry is, however, now so widely disseminated that there is scarcely a hope for an immediate reform in this nomenclature, although "general chemistry" or "generalized chemistry" would have been a far more faithful term with which to designate these recent advances.

The use of physical chemistry to designate this new branch of science has, it must in fairness be stated, some justification in the fact that the generalizations which underlie it were reached, as we shall see, through the application of physical methods to chemical processes, and this is the historical significance of the term.

Discovery of the Law of Mass Action

The first great generalization, to take them up historically, which led to the recent advances, was reached in 1867, by the Norwegian physicist, Guldberg, and the Norwegian chemist—his son-in-law—Waage. It had been known long before their time that the relative quantities of the substances that were brought together had an influence, in some cases very marked, on the chemical reaction that would take place between them. This influence was in some cases so great that not only the velocity of the reaction in question, but the very nature of the reaction, i.e., the direction in which it would go, and, consequently, the products formed, would be determined by it.

The importance of quantity or mass in chemistry was first clearly recognized by that very great French chemist of the first decade of the nineteenth century—Berthollet. But this man, like so many other really great men, was ahead of his time; or, as we say, the time was not ripe for him, and the importance of his work was neither seen nor appreciated for half a century. During this period, there were a number who caught glimpses of the importance of mass or quantity, which had been pointed out much earlier by Berthollet, but no one for 50 years saw it half as clearly as he had done.

It remained for another French chemist who died recently—Berthelot—almost exactly 60 years later (1862-1863), to furnish the experimental basis for the formulation of the effect of mass in chemistry—for the discovery of the law of mass action.

Berthelot and a co-worker who afterward acquired distinction—Saint Gilles—studied the following chemical reaction:

When a strong acid like sulphuric is treated with a strong base like sodium hydroxide, molecule for molecule, the reaction is, as we say, complete—all of the acid is neutralized by all of the base.

The Acetic-Acid Alcohol Reaction Studied

When, on the other hand, a weak acid like acetic is treated with a weak base like alcohol, the reaction does not proceed to the end; but when equivalent quantities, i.e., an equal number of molecules of the acid and base are used, the reaction proceeds only about two-thirds of the way toward the end. Only about two-thirds of the acid reacts with two-thirds of the alcohol, giving two-thirds of the ethyl acetate that would be formed if the reaction were complete. This was the reaction which Berthelot and Saint Gilles studied, to see whether the relative quantities of the substances present would have any effect on the relative amounts of ester formed. They took a given quantity of acetic acid and added just enough alcohol to combine with just one equivalent of acid; and determined the amount of the ester formed.

They then took a fresh quantity of acetic acid and added two equivalents of alcohol and determined the amount of the ester produced; then to another sample of acetic acid they added four equivalents of alcohol, to another 12, and finally 50 equivalents of alcohol to one of the acid, determining in every case the amount of ester that was formed.

This is obviously one of the best chemical reactions that could have been chosen to study the effect of quantity or

mass in chemistry. If the amount of ester that was formed should increase as the amount of the alcohol relative to the acid was increased, it would be due to the mass action of the alcohol, since this was the only thing that had changed in the reaction. What was the fact?

When one equivalent of the alcohol was added to the acid, just two-thirds of the theoretical amount of ester was formed, as has been stated. When two equivalents of alcohol were used 83% of ester was produced. With four equivalents of alcohol the ester increased to 88%; with 12 equivalents to 93, and with 50 equivalents to 100% ester.

The above results were so clean-cut, unambiguous and therefore convincing, that after their publication no one seriously doubted the effect of mass in chemistry; but this effect was not yet formulated.

It remained for the Norwegians already referred to, to take this epoch-making step.

Work of Guldberg and Waage

In the program of the University of Christiania for 1867, the physicist Guldberg and the chemist Waage published a paper which was destined to exercise a most potent influence in the development of chemistry—as a whole. They supplemented the work of Berthelot and Saint Gilles with a number of experiments of their own, bearing upon the effect of mass as conditioning chemical reaction.

They studied especially the reaction between barium sulphate and potassium carbonate. If solid barium sulphate is boiled with a sufficient quantity of an aqueous solution of potassium carbonate, practically all of the barium sulphate is transformed into barium carbonate, a corresponding amount of potassium sulphate being formed.

If, on the other hand, solid barium carbonate is boiled with a sufficient amount of a solution of potassium sulphate, practically all of the barium carbonate is transformed into barium sulphate, a corresponding amount of potassium carbonate being formed.

This reaction is one of the best in all chemistry as illustrating the effect of mass in changing not only the velocity and magnitude of a chemical reaction, but even in changing the direction in which the reaction will go. But this is all purely qualitative.

A quantitative study of this reaction enabled the Norwegians to formulate the law of mass action. They determined the amounts of all of the substances entering into this reaction, and the amounts of the products formed, both when the barium sulphate was being transformed into the carbonate, and when the barium carbonate was being transformed into the sulphate.

If we represent the amount of the barium sulphate which takes part in the reaction by p, the amount of the potassium carbonate taking part in the reaction by q, and the velocity of the reaction by v, the equation expressing the velocity of the reaction is:

$$v = pqk$$

in which k is a constant whose value depends upon the nature of the substances taking part in the reaction. The velocity of this reaction was thus shown to be equal to the *product of the active masses of the substances taking part in the reaction, times a constant.*

This equation was then shown to apply to the velocities of chemical reactions in general, and is the expression of the law of mass action for the velocities of chemical reactions—*chemical reactions are proportional to the products of the active masses of the substances taking part in the reaction.*

Guldberg and Waage, however, did not stop here. Chemical reactions often proceed to a certain distance and then appear to stop. As it is usually expressed, a condition of equilibrium is reached. What is this condition? Do chemical reactions actually proceed to a certain point and then stop, or do they only appear to do so?

Chemical Equilibrium

Guldberg and Waage showed that chemical equilibrium is a condition that is very different from what it was supposed to be in the early half of the nineteenth century. It was the English chemist Williamson, recently deceased, who called attention in 1851 to the nature of chemical equilibrium. Before his time chemical equilibrium had been looked upon as a condition of rest—a reaction proceeded so far and then stopped, and this was the condition at equilibrium. In a word, chemical equilibrium was regarded as a static condition, as a condition of *rest.*

Williamson, in his work on the preparation of ordinary ether by the action of sulphuric acid on ethyl alcohol, was forced to the conclusion that the conception of chemical equilibrium then in vogue was fundamentally wrong. Suffice it to say, without going into unnecessary detail, that Williamson could not account for the facts that he had discovered in connection with his study of this reaction in terms of the statical or rest conception of chemical equilibrium. In the first stage of the reaction the sulphuric acid combined with the alcohol, forming ethyl sulphuric acid; while in the second stage of the reaction more alcohol reacted with the ethyl sulphuric acid, reforming sulphuric acid and forming ether.

There were thus two stages to the reaction, or in reality two reactions going on simultaneously, the one, in a sense, the reverse of the other, and this is the key to Williamson's interpretation of chemical equilibrium.

Chemical Equilibrium Dynamical

We have in general two reactions taking place at the same time, the one between the initial substances giving rise to certain products, and at the same time the products of the first reaction react with one another, reforming the original substances. When equilibrium is reached, these two opposite reactions have *the same velocity;* as much of the products of the first reaction being formed in a given time as decompose in that same time. Chemical equilibrium is then not static, not a condition of rest, but dynamic. It is simply that condition where the two opposite reactions have acquired the same velocity. This, as we shall see, is of fundamental importance in connection with the whole subject of reversible reactions. This work of Williamson was published about 16 years before the discovery of the law of mass action by Guldberg and Waage, as has already been stated. The latter, therefore, applied their law not only to the velocity of chemical reactions but also to chemical equilibrium, and as follows:

Equilibrium is the condition where the two opposite reactions have the same velocity. If we represent the velocity of the first reaction by v, and that of the counter reaction by v_1, we have

$$v = kpq$$

If in the counter reaction the active mass of one of the substances is p_1, and that the other substance is q_1, the velocity v_1 is

$$v_1 = k_1 p_1 q_1$$

where k_1 is a new constant. Thus was discovered the law of mass action, not only for the velocity of chemical reactions but also for chemical equilibrium. Some idea of the importance of this generalization will be gathered from the later chapters of these papers. Let us now turn to the discovery of the second great generalization which made the new physical chemistry possible.

Applicability of the Laws of Gas Pressure to Osmotic Pressure

There was born in Rotterdam in 1852 a son who was destined to become one of the greatest men of science of all time; a man who found chemistry one thing, and who left it something entirely different. I refer, of course, to Jacobus Henricus Van't Hoff. After studying at the Polytechnic Institute in Delft, he went, at the age of 20, to the University of Leiden, Holland. A little later he went to the University of Bonn in Germany to work with August Kekulé, who was then the most prominent figure in chemistry, especially the chemistry of carbon, or

organic chemistry as it is usually called. From Bonn, Van't Hoff wandered to Paris to work with Würtz, who was at that time one of the leading French chemists. Van't Hoff then returned to Utrecht, Holland, where he received the doctor's degree at the age of 22. At the age of 26 he was appointed professor of chemistry in the University of Amsterdam, a position which he held until 1896, when he accepted a call to the University of Berlin, where he remained until his death on March 1, 1911.

What did this man do which placed him in the very front rank of men of science?

While working with his various teachers he showed an unusual originality, which at times expressed itself in open opposition to the prevailing conceptions of that period. He was especially dissatisfied with the condition of organic chemistry. To bring certain substances together, to allow them to react as under the conditions they would, and after the reaction was all over simply to determine the nature of the products formed, appealed to him as most unsatisfactory.

This, he recognized, was studying simply the beginning and end of the transformation, and leaving the intermediate steps to take care of themselves, and it was these intermediate steps which were by far the most interesting.

Van't Hoff wanted to know something about the velocities with which chemical reactions take place, and the effect of varying such conditions as temperature, pressure or concentration on these velocities. He wished to know the real conditions present when equilibrium was reached in chemical reactions, i.e., when the two opposite reactions acquired equal velocities. These were the kinds of questions to which his mind turned, and he realized that we could never have a real science of chemistry until such questions were raised and answered.

Osmotic Pressure of Solutions

When he was revolving such questions as these in his mind, he communicated his line of thought to his colleague Devries, the botanist of the University of Amsterdam, and Devries referred him to the work of another botanist, Pfeffer, on the osmotic pressure of dilute solutions of a few substances, which Pfeffer had measured with considerable care. This was the introduction of Van't Hoff to Pfeffer, and to the work of Pfeffer on the osmotic pressure of dilute solutions.

From the comparatively few data furnished by Pfeffer on the osmotic pressure of solutions, Van't Hoff, with that insight which is characteristic of a great genius, saw relations which almost anyone else would have failed to discover. The osmotic pressure of a 1% solution of cane sugar was found by Pfeffer to be 53.5 cm. of mercury. A 2% solution exerted an osmotic pressure of 101.6 cm.; a 4% solution 208.2 cm. and a 6% solution 307.5 cm. of mercury. If we divide the osmotic pressure by the concentration we obtain nearly a constant value[2].

The importance of this fact would not have been seen by an average mind; indeed, not by anyone of smaller caliber than Van't Hoff himself. Here we have two variables, concentration of the solution and the osmotic pressure which it exerts, and one is proportional to the other, one is a linear function of the other, and in this alone there is nothing remarkable. We know of many such cases in science—one variable being a linear function of another. Expressed in simple words it says only this that two molecules of cane sugar exert just twice the osmotic pressure of one molecule, and this is certainly not surprising. To Van't Hoff it said far more than this. Boyle's law for gases states that gas pressure increases proportionally to the concentration of the gas, i.e., the pressure is a linear function of the concentration of the gas; by the concentration of a gas is understood the amount of the gas in a given volume. Two gas molecules in a given volume exert twice the pressure of one. There was thus an analogy between the osmotic pressure of solutions of cane sugar and the gas pressure exerted by gases; but thus far it was only an analogy.

Having found that one law of gas pressure applied to the osmotic pressure of solutions of a substance like cane sugar, Van't Hoff then looked about to see whether osmotic pressure conformed to any other laws of gas pressure.

Another well known law of gas pressure is that of Gay-Lussac, which has to do with the temperature coefficient of gas pressure. A gas increases in volume $^1/_{273}$ for every rise in temperature of 1° C., pressure remaining constant, or the pressure increases $^1/_{273}$ if the volume is kept constant. The question then is, does osmotic pressure increase with rise in temperature, and if so, does it increase at the same rate as gas pressure?

Pfeffer measured the osmotic pressure of a given solution of cane sugar at different temperatures, and thus enabled us to calculate the temperature coefficient of osmotic pressure. The result from Pfeffer's measurements was not satisfactory, ranging from about $^1/_{250}$ to $^1/_{300}$. There is, however, an indirect method of answering this question that gave satisfactory results.

Principle of Soret

Given a glass tube filled with a homogeneous solution, this solution will remain homogeneous just so long as all parts of it are kept at the same temperature. If one part is kept warmer than another, the solution will soon cease to be homogeneous—the warmer part will become more dilute and the colder part more concentrated. This heterogeneity is brought about by diffusion of the dissolved substance from the warmer to the colder part of the solution. Diffusion, as we shall see, is due to osmotic pressure. It is, therefore, osmotic pressure that drives the dissolved substance from the warmer to the colder part of the solution. A warm molecule exerts more osmotic pressure than a cold one. The dissolved substance will distribute itself throughout the solvent so that the osmotic pressure will be equal in all parts of the solution; consequently, the difference in the concentration of different parts of a solution which are at different temperatures. This is known from its discoverer as the principle of Soret.

If osmotic pressure obeys the law of Gay-Lussac, then it is a perfectly simple matter to calculate the difference in the concentration between the warmer and the colder parts of the solution. If the difference in temperature between the two parts of the tube is 50°, the difference in concentration when equilibrium is established would be $^{50}/_{273}$ of the original homogeneous concentration.

The experimental results confirm the theoretical conclusion. When the tubes containing the solution were allowed to stand for a sufficient length of time, the difference in concentration found between the two parts of the solution agreed with that calculated on the assumption that Gay-Lussac's law applies to the temperature coefficients of osmotic pressure of solutions. Gay-Lussac's law, then, applies to the osmotic pressure of solutions as well as the law of Boyle.

Before leaving this "principle of Soret" a few lines should be added both from the scientific and the technical side. A solution remains homogeneous only so long as all parts of it are kept at the same temperature. The osmotic pressure in the different parts must be kept exactly the same in order to preserve by diffusion the same concentration throughout. "Standard solutions" are used in a large number of quantitative determinations. These solutions, after having been carefully standardized, are often set aside until desired for use. If

[2]Osmotic pressure is detected and measured by placing the solution on one side, and the solvent on the other side of what is known as a semi-permeable membrane. A membrane such as is used for such purposes is formed by precipitating a gelatinous substance in the walls of an unglazed porcelain cup. The substance most frequently used for such purposes is copper ferrocyanide. The solvent passes through such an artificial membrance into the solution, but the dissolved substance cannot pass outward through the membrane, which is consequently termed semi-permeable. The pressure produced by the water passing in, is measured usually by a mercury manometer.

the analyst is not familiar with the principle we are now discussing—does not know that all parts of the standard solution must be kept at the same temperature or the standard solution is rendered worthless, he is apt not to take the necessary precautions to place his standard solutions for volumetric work where all parts are kept at the same temperature. If the homogeneity of a standard solution is destroyed by unequal temperatures, the usual shaking of such solutions is not sufficient to make the different parts of the same concentration.

Avogadro's Law Applied to Solutions

The laws of Boyle and Gay-Lussac apply to the osmotic pressures of solutions. This relation, however, tells us nothing about the actual value of osmotic pressure as compared with gas pressure under similar conditions; i.e., where the gas has the same concentration as the solution, containing the same number of gas parts in a given volume of the gas as there are dissolved parts in the same volume of the solution. This is, after all, the most important question.

What relation is there between the actual gas pressure exerted by, say, hydrogen gas, and the osmotic pressure of a solution of cane sugar containing as many molecules of cane sugar in a given volume of the solution as there are hydrogen molecules in the same volume of the gas? Van't Hoff made this comparison and with the following result, also extending the comparison to different temperatures.

Taking hydrogen gas of such a concentration that at 6.8° it would exert a gas pressure of 0.665 atmospheres, and preparing a solution of cane sugar of the same concentration as the hydrogen gas, we can calculate its osmotic pressure. The accompanying table shows the relations between the two pressures—gas pressure and osmotic pressure from 6.8 to 36°.

Temperature	Gas pressure	Osmotic pressure
6.8°	0.665	0.664
15.5°	0.686	0.684
36.0°	0.735	0.735

The surprising result comes out that the gas pressure of a gas is exactly equal to the osmotic pressure of a solution of the same concentration as the gas.

This is among the most remarkable relations ever discovered. In a word it is the application of Avogadro's law for gases to the osmotic pressure of solutions. We have, on the one hand, matter in the form of a gas with all of the properties of a gas—practically unlimited expansibility, molecules moving through space with enormous velocities. On the other hand we have a solution of one substance in another—a solid, cane sugar, in a liquid, water; the molecules of the sugar moving with almost infinitesimal velocity through the solvent, and yet the gas pressure of the one is exactly equal to the osmotic pressure of the other.

Our astonishment at this relation is still further increased by the fact that while we know the cause of gas pressure, we know practically nothing as to the cause of osmotic pressure. Gas pressure is explained by the kinetic theory of gases—the pressure is due to the impact of the rapidly moving gaseous particles against the walls of the containing vessels. About all that we really know as to the cause of osmotic pressure is that it is in some unknown way connected with surface tension. Yet the two pressures are identical in magnitude.

The result of this epoch-making work of Van't Hoff was then to show that the laws of gas pressure apply to the osmotic pressure of solutions of substances like cane sugar.

Importance of Gas Laws Applying to Solution

The question that arises here is, why is this of sufficient importance to call it epoch making, or why is it important at all? We know very little about matter in the solid state. We know the shapes of the crystals which it forms, and to some extent how solids conduct the various forms of energy such as heat, light and electricity; but these are after all comparatively superficial matters.

When we come to liquids, our knowledge is far more satisfactory than with solids, but even here the fundamental problems for the most part remain to be solved.

With gases it is different. We know incomparably more about matter in the gaseous than in any other state of aggregation. Indeed, it is no exaggeration to say that many of the fundamental problems in connection with gases have been solved. We can deal with gases by the only exact method, viz., the mathematical. We can apply the methods of thermodynamics to matter in the gaseous state.

We shall see that solution is the most important condition of matter from the standpoint of the natural sciences. Matter in the pure, homogeneous condition has very little activity, chemical or otherwise. It becomes active only when mixed with foreign matter—when it is dissolved, as we say.

The generalizations reached by Van't Hoff enable us to apply the same methods to them that we use with gases; the latter being the state of matter about which we know most; while solutions are incomparably the most important state of matter from the standpoint of natural science in general. The importance of this advance, if not obvious from what has been stated, should become so as we progress.

It has been stated that the laws of gas pressure apply to the osmotic pressure of solutions of substances like cane sugar. Why this limitation? Do the laws of gas pressure not apply to osmotic pressures of all substances? If not, what classes of compounds present exceptions to these relations?

The laws of gas pressure apply to the osmotic pressures of nonelectrolytes, of which cane sugar is an example, i.e., to those substances whose aqueous solutions do not conduct the electric current. These include, in general, the neutral organic compounds. But these are by far the least interesting and least important chemical compounds.

All of the acids, bases and salts, i.e., all of the electrolytes, or those substances whose aqueous solutions conduct the current, present exceptions to the above relations. The laws of gas pressure do not apply to the osmotic pressure of a single one of them. They all exert osmotic pressures that are too great in terms of the pressures exerted by nonelectrolytes.

Van't Hoff recognized this fact and stated it clearly in his first paper in which the above relations were announced—in the *Zeitschrift für physikalische Chemie*, Vol. I, p. 481 (1887). He was, however, unable to explain the apparent discrepancy. This remained for a young Swedish physicist.

A Peculiar Tin Mine

In his report on the local tin mining, Meadows Frost, adviser to the Perlis, Federated Malay States, Government, writes (*Engineer*, Feb. 2, 1912):

"The mining is most peculiar, the ore being found in underground streams and hollows in the limestone range which separates Perlis from Setul. People who have been all over Perak and the other States of the Federation unite in saying that the Perlis mines are unique. The miners have followed up an underground stream for over three miles, the entrance to which is through a steep funnel, down which the coolies crawl for a quarter of a mile before reaching the stream in which the ore is found, and which opens out at different places into large caverns."

The only hydraulic phosphate mining plant in Tennessee is on Swan Creek, about four miles from Centerville, on a spur track of the Nashville, Chattanooga & St. Louis Ry. The hydraulic method of mining is used in the Florida phosphate fields to considerable extent, states *American Fertilizer*, but this plant is the first to be successfully operated in the Tennessee district.

Argentine Government Aërial Tram

By C. A. Tupper*

Description of the government-owned line extending from Upulungos in the mountains of the Famatina district to Chilecito. The air-line distance is about 22 miles and the difference in elevation, 11,574 ft. The down capacity is 40 tons per hour; the up capacity, four tons.

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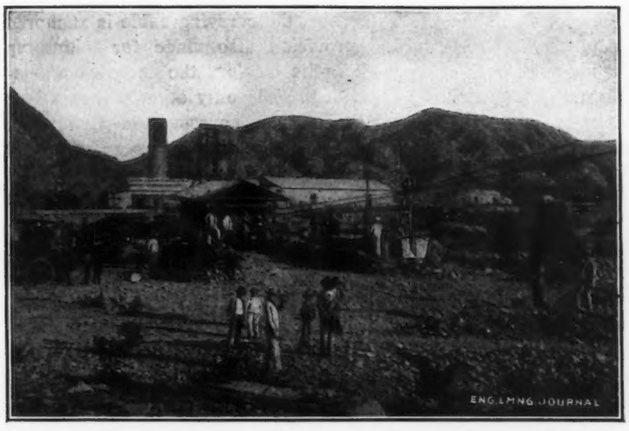
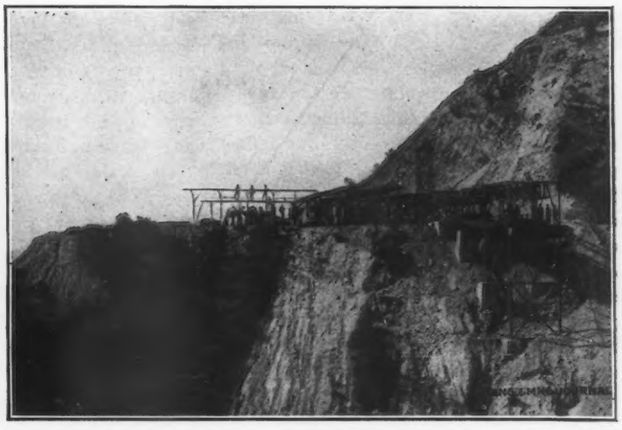
Among recent enterprises undertaken by governmental authorities for the encouragement of mining, the most notable has probably been the construction, in behalf of the Argentine Republic, of the aërial tramway from Chilecito, at the foot of the Andes in the province of Rioja, to the mines of the Mejicana Mountains in the Sierra de la Huerta range, sometimes known collectively as the "Famatina" workings. This tramway has a rise of 11,574 ft. in a horizontal distance of about 21½ miles. Chilecito is about midway between 65° and 70° west of Greenwich and 29° south of the equator. It is the terminus of a line of railway from Cordoba, which connects with the trunk road to Rosario, Buenos Aires and La Plata. The place has a population of about 5500, and copper-smelting works have been erected there by the Famatina Development Corporation, a British company.

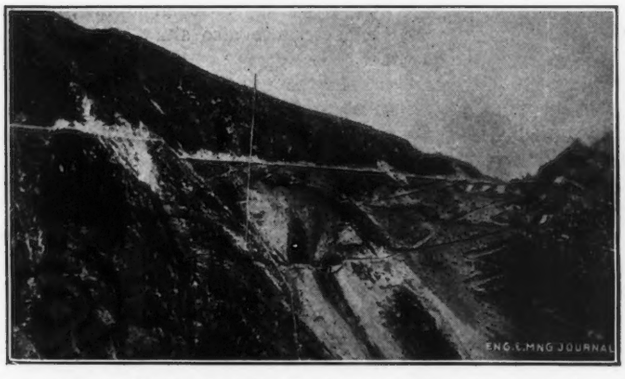
The various mines of the Famatina district, scattered over numerous mountain slopes, of which a small settlement known as Upulungos is the established center, were originally worked for the Incas, and after the Spanish conquest their exploitation was continued by the natives under the direction of the Jesuits. At the time of the War of Independence, however, the latter withdrew from the district and all mining operations ceased. In subsequent years these were again inaugurated by various individuals in a desultory fashion but gradually increased. All of this ore had to be carried down a difficult and extremely circuitous path over 90 miles in length. At Chilecito the copper was smelted to a first matte and sent by railroad to Buenos Aires to be forwarded to Europe for refining.

The federal government of Argentine made an investigation of the possibilities of a systematic development of the district, and, having interested foreign capital, proceeded to outline plans for opening regular and continuous communication between the mountain slopes and the plain. At first a cog railway was projected; but the enormous difficulties and expense of construction led to the abandonment of this plan. Finally an aërial tramway was decided upon, Adolf Bleichert & Co. of London and Leipsic being the successful bidders. It is from this firm, which I called upon in Leipsic, that the following details of construction and operation were obtained.





TERMINAL STATION AT CHILECITO AND PARRON STATION DURING CONSTRUCTION, ARGENTINE TRAMWAY



LOWER MOUTH OF THE TUNNEL DURING CONSTRUCTION

ARGENTINE TRAM CROSSING SAN ANDREAS VALLEY

LOWER TERMINUS AT CHILECITO

The aërial tramway, which is designed for a down capacity of 40 tons and up loads aggregating four tons or more hourly, with buckets holding about 1125 lb. of ore and traveling at a speed of approximately 8.5 ft. per second, has its beginning near the steam railway terminal at Chilecito. The station here for unloading the ore includes large bins overhung by a loop track, and the incoming loads are dumped by tripping.

after being automatically weighed and recorded. From the bins the ore is discharged through hopper bottoms into railroad cars on a lower level. This station has no driving machinery and is simple in construction. The carrying cables are firmly anchored and the traction-cable tension suitably provided for by a system of connecting cables, idlers and weights.

From this point, which lies at an elevation of 1075 m. above sea level, the line is carried to Upulungos, 3528 m. higher and distant by air line 34.3 km., with division into 9 operating sections, each of which has its own traction cable. The first, to station No. 2, is 8958 m. in length, with a rise of 5.2%. For this stretch the line is subdivided, although with a continuous traction cable, into three parts, by means of two double tension towers; and near the center point there is a single tower for anchoring the carrying or track cables, illustrated by the accompanying engravings. Similar provisions, with additions to be noted farther on, obtain all along the route, according to conditions. The tension cages and removable weights, which are characteristic of the arrangements at all stations and tension towers, may be plainly seen in the illustration, also the type of supporting tower ordinarily used and the telephone line which was independently constructed by the side of the tramway.

At station No. 2 there are a steam boiler and an engine of 40 hp. to furnish power for keeping the traction rope in motion on the stretch below and exercise any necessary braking force. Quarters for attendants, a repair shop and a side track on to which buckets carrying supplies can be switched, are also provided. The through loads pass from one carrying cable to the other on a rail track and are automatically uncoupled and coupled again to the traction cables.

From this station, the tramway, which has heretofore traversed level ground, ascends the slopes of Mt. Durazno along the cuttings shown in an accompanying engraving, crosses the Amarillo River at 14.5 km. from Chilecito and enters station No. 3, designated as Parron, 17.5 km. out. Here driving machinery is installed for the stretch below. Attendants' quarters are also provided but no repair shop, as the station is perched on the shoulder of a steep declivity. The down grade from Parron to the station below is 5.2%; the distance 8486 meters.

The sheer rise of the line from this point is indicated by the tower in the upper right-hand corner of an accompanying illustration, far up the slope of the mountain. The difference in elevation between stations Nos. 3 and 4 is 565 m., or 18.5% over a distance of 3054 m. The upper station, named Rodeo de las Vecas, is 20.5 km. from Chilecito. Here the driving mechanism serves both the upper and lower stretches but is no greater in capacity than the others mentioned and is merely intended to keep the traction cable in motion; for, when the line is fully loaded, there is excess energy which has to be neutralized by braking, so far as not applied to minor purposes about the station. The usual attendants' dwelling was erected.

Line Goes through One Tunnel

The line up to station No. 5, or Cueva de Romero, covers the most difficult part of the route, although the net grade does not quite reach 5%. This is owing to the fact that several peaks have to be crossed and the tramway then carried through a 150-m. tunnel, 4½ m. wide, 4 m. high and inclined upward. The accompanying engravings show the entrance to the tunnel during construction and a view from the interior. At each end there are tension weights. On the farther side of the tunnel the remaining distance to the station above includes two long spans 258 and 540 m., one of which crosses the valley of the San Andreas River, to the side of Cerro Negro. The rise for the entire distance of 3095 m. is 150 m. or a little more than 4.8%. Station No. 5 has no driving machinery. There are tension appliances for both the upper and lower traction cables and also heavy weights on the upper carrying cables in addition to the usual anchoring. An attendants' dwelling is the only other feature.

From this point on, the line begins to go up precipitately over the peaks and crags of Mt. Cielito Rodado y Cabrera Moreno. In the distance of 1946 m. to station 6, there is a rise of 554.6 m., or nearly 28.5%. This point, designated Cielito, has driving machinery for the lower traction cable and tension arrangements for the upper, with switch track and attendants' quarters. Leaving here the tramway continues on over the stream Rio del Rodado, which it crosses in a 670-m. span, and a little farther there is another long span of 575 m. The total rise is 667 m., or 29.4% in a distance of 2267 meters.

Station 7, known as Cueva de Iltanes, lies 27.8 km. from Chilecito at an elevation of 3911 m. It is provided with driving machinery for the lower traction cable and tension appliances for the upper, with switch track and attendants' quarters, which at all of the upper stations include space for repair outfits.

Between Cueva de Iltanes and Bayos, as station No. 8 is known, there is a cable length of 3072 m. and a rise of 460.5 m., or nearly 15%. This part of the route includes one span of almost 800 m. Station 8 has driving arrangements for both the upper and lower stretches but is otherwise constructed similarly to station No. 7. In both stations the lines entering and leaving are at more of an angle to each other than has been the case on the intermediate sections. From station No. 7 on, the temperature at night is below freezing point, and in winter the mean temperature at the higher altitudes is 20° below zero Centigrade.

Upper End of Tram at Upulungos

Between station No. 8 and the upper end of the tramway at Upulungos, the distance is 3450 m., with a rise of 232 m., or a little over 6.7%. Included in this are spans of 600 and 900 m. Not far from Bayos, owing to a heavy dip in the line, the carrying cable is anchored and provision also made for taking up slack in its tension, the same as at station No. 5. The only other places where this was found necessary is midway of stations Nos. 2 and 3, where the total distance is 8486 m. and a succession of long spans had to be provided for, and also at the Bello Plan station. The latter is situated on the last mountain slope before reaching Upulungos and forms the real terminus of the tramway, the remainder of the distance being covered by a relatively short section in a single span. The Bello Plan station has driving machinery for both the upper and lower traction cables and consequently none had to be provided at the end of the line in Upulungos. Attendants' quarters, main upper repair outfits, switch track, etc., are also situated at the former.

With the tramway loaded to 40 tons hourly capacity there is an excess of power, theoretically, on the down grade of 37, 33, 71, 11, 82, 88, 59 and 24 hp., enumerating from Chilecito, for the eight sections respectively, with actual reduction in consequence of friction. This excess is neutralized by the braking appliances.

Between stations there are 275 supporting towers, spaced from 100 to 900 m. apart. Their construction may be plainly seen from the illustrations. Everything, including these towers, the tension structures and the stations, is built of iron, over 2000 tons of which were used. The carrying line is entirely wire cable, except through the tunnel and in one place beyond station No. 7 where the line would not clear the profile of an intervening peak without higher, more expensive suspension, increase in grade, etc., and a rail track supported by short columns offered the most economical solution of the problem. Besides being anchored at both terminals, the line is similarly secured at the eight intermediate stations and nine other points *en route*, with provision for the

proper tension of the carrying cables as above enumerated.

Two Types of Cable Used

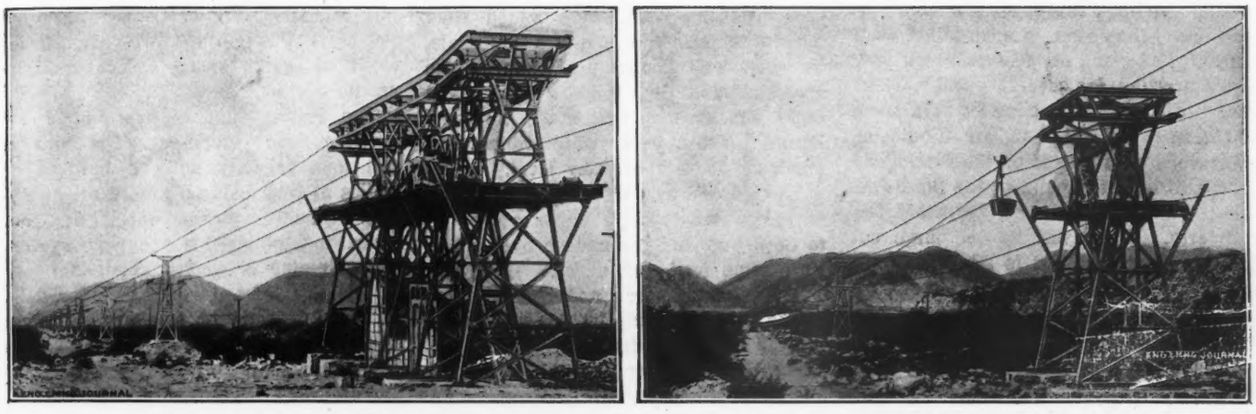
In order to keep the cost of construction and maintenance as low as consistent with safety and economy of operation, the choice of the carrying or track cable was carefully made, with due regard to the particular service conditions of each section of the line. For the heaviest gradients the wire cables used are of the so called locked-coil type, and the best grade of smooth-coil cable was selected for the remainder. The kind of steel-strand cable. All cable lengths are fastened together and all connections made by patent coupling originated by the tramway builders.

In order to provide carriage grips which would adapt themselves to varying cable diameters on different sections owing to differences in wear, the bucket carriages were provided with the Bleichert patent "automat" coupling, with underhung grips which operate automatically. These hold the buckets with absolute security in a vertical position at any grade and are self-adjusting to variations in the traction cables. For the carrying cables there are special shoes which prevent springing.

Care was taken in the construction to have all connecting rails at stations and towers exactly in line with the carrying cables, so that there is no shock or reaction as the loads enter and leave. The ore buckets are of strong steel plate. Receptacles for water, coal and other supplies, double-carriage platforms for boxes or other material, and passenger cars like sedan chairs are also in service.

For lubrication of the carrying cables a special traveling oiler was furnished by the builders. This consists of a carriage underhung by a receptacle in which there is an oil tank and a small pump. The latter is so connected to the moving wheels of the carriage that it is kept constantly in operation and sends a light spray between them on to the carrying cable. One filling of the tank would suffice for about a third of the entire line; but an oiler is kept in service for each stretch between stations. For the traction cable there is a ring oiler installed with the sheaves at the station, so that the cable is oiled as it turns. Communication between stations is maintained over the independent telephone line which follows the tramway, and the attendants are equipped with portable sets so that they can cut in at any point along the route in case of need.

The work of construction was completed in a little more than a year, in spite of enormous difficulties to be overcome. There is, in the entire enterprise, much that can be emulated in other parts of the world, including the United States and neighboring countries.



Double Tension Tower for Traction Cables and Anchoring Tower for Carrying Cables

Loading Supplies on Switchtrack; View from Tunnel Interior and Upper End of Argentine Tramway

diameter of the locked-coil cable is 35 mm. for the loaded line and 26 mm. for the lightly burdened return; while the smooth-coil cable measures 32 mm. and 30 mm. for the down line of the upper and lower stretches, respectively, and 23 and 25 mm. for the corresponding reaches of the up line. The traction cable is of equally good quality and strength for the operating requirements. In tightening the cables, chains have not been used, owing to rapid deterioration from unfavorable climatic conditions, but the tension weights are hung by a special

Notes on Pioche, Nev.

By Edward R. Zalinski*

Construction was started Feb. 9, 1912 on the new railroad branch which will connect the Prince mine with the spur of the San Pedro railroad at Pioche. This branch will be standard gage, 8¾ miles long, with a maximum grade of 2%, and will run from Pioche westerly around the north side of the Pioche Range, circling the northwest end of the range, and running southeast down the southern side to the Prince Consolidated mine.

The grading contract has been let to the Thompson Construction Co. of Salt Lake, and supplies and men have been arriving for several weeks. There are two construction camps where about 50 teams and 80 men are employed. Work has been started on the Pioche end and also near the point at the northwest end of the range near the Pioche Metals property. There will be one large cut and fill here; the cut is 22 ft. deep in places, and 250 ft. long. There are other cuts and fills, but except the one mentioned there is little heavy work to be done.

The new branch will probably be ready to traffic by summer or early in the autumn. A separate company is to be organized, controlled by the Prince Consolidated, to complete and operate the road.

Bullionville Tailings Shipped to International Smeltery

The Prince Consolidated company is shipping five to eight cars (200 to 300 tons) daily, from the tailings at Bullionville to the International smeltery at Tooele, Utah. The proceeds from these shipments will be used in the construction of the railroad to the mine. It is understood that there are in the neighborhood of 40,000 to 60,000 tons of tailings at Bullionville from the mills which were operated in the early days of the camp. Stamps were used principally, though other crushers were tried. Some of the tailings have since been cyanided, but even these can be profitably shipped. The current talk is that a little over half of the tailings can be sold at from $6 to $7 per ton, while the remainder will bring about $4. There are also some sands which may be shipped later, though these may be worked over or concentrated first. The tailings are loaded on the cars by men and teams at a cost of 35c. per ton. About 267 cars, or 12,015 tons have been shipped. A new tailings pit will soon be opened, which is estimated to contain about 32,000 tons; approximately, two-thirds of this will be shipped.

Low-Grade Ores May be Shipped

Pioche has been quiet for some time, especially since the Nevada-Utah difficulties. Since the work has been started on the branch line, the town and district have taken on new life and now that better shipping facilities will be available, preparations are being made to resume work at many properties.

Cheap transportation is a necessity, as the ores at present are mostly of medium- or low-grade. In the early days of the camp, higher grade silver ores, carrying some lead, were mined from fissure veins in the quartzite and shale, by such well known producers as the Raymond and Ely, Meadow Valley and other mines which first made the camp known. These veins were worked extensively above the water level.

The greater part of the ores at present being mined carry an excess of 25 to 35% iron and manganese over silica, with some lead and silver. These are desirable fluxing-ores and a large part of the payment made by the smelters is for the excess of iron, manganese and lime. A typical ore of this character assays 4 oz. silver, 5% lead, and 30% excess iron. In some cases there is a small amount of gold present, 20 to 40 cents.

The geological section at Pioche from older to younger consists of: Cambrian quartzite, 1500 ft.; shale, 400 ft.; limestone, 600 ft. or over; shale, 75 ft.; limestone, 800 ft., more or less eroded.[1] There has been strong fissuring and faulting, the displacements in some cases being large, with upthrows of several hundred feet.

Iron-Manganese Ores in Limestone and Shale

The iron-manganese ores occur in good-sized bodies, up to 250 ft. in length and more than 100 ft. in width and thickness, along the contact of the lower or 600-ft. limestone and shale, replacing the limestone in the neighborhood of mineralizing fissures. Shale forms the foot wall of some of the most important bodies so far developed. Iron-manganese ores also occur in the limestone beds above the shale, and in the shale beds of the 400-ft. series. Some of the orebodies here are 20 ft. or more in thickness.

A higher grade silicious silver-lead ore also occurs in the lower shale, and replaces certain beds with considerable regularity. The beds replaced are from four to eight feet in thickness. A typical ore of this character will average about 12% lead, 16 oz. silver, and $2 gold, with an excess of 20% silica. This ore occurs in workable quantities in the mineralized fissures. In the Highland district a few miles west of the Pioche Range, the ores, silver with lead, occur largely in fissure veins though there are some bedded deposits.

At present none of the mines on the north side of the camp are operating. Some work is being done at the Pioche Metals at the northwest point of the range, and by properties on the south side, along the line of the new railroad. The Demijohn is employing a few men, the Pioche Coalition Mines Co. is working, and the Virginia-Louise, near the Prince, is sinking a new two-compartment shaft, in search of the Prince ore zone on the south.

The Prince mine is overhauling the buildings and equipment. Ore bins of 650 tons capacity will be built. The bodies of iron and manganese ore at this property will be further opened and prepared for mining by a caving system. When mining is started about 200 tons of this class of ore will be shipped daily to the International smeltery, in addition to the tailings now being shipped from Bullionville. The Prince also has higher grade silver-lead ores developed on the lower levels, in the 400-ft. shale beds and in fissures.

The Pioche King northwest of the Prince will probably resume development.

The Day-Bristol mine at Jack Rabbit, owned by the Nevada-Utah, is shipping two cars of iron-manganese ore daily. Ore carrying copper is mined at intervals. Jack Rabbit is 14 miles southwest of Pioche.

Mines in the Highland District

A new prospect has recently been opened in the Highland Range about six miles south of the Day-Bristol. This is called the Home Run and is controlled by Salt Lake men. The ore is composed chiefly of copper silicate (chrysocolla) carrying some silver. A small gasoline hoist has been installed.

The mines of the Highland district should be benefitted by the new railroad to the Prince mine, as it will reduce the wagon haul by several miles and it is down grade from most of the properties to the railroad. It is proposed to put in a 500-ft. spur south of the Pioche Metals and build a loading platform so that loading can be done direct into the cars. The mines in the Highland district are the Mendha and Last Chance; they are being worked at present. Work is being done at the Highland Mary, and at the X-Ray on the eastern slope. The railroad will cause work to be resumed at other mines or prospects in this district.

*Mining engineer, 607 Newhouse Building, Salt Lake City, Utah.

[1]"Geology of Pioche, Nevada and Vicinity," by F. J. Pack, School of Mines Quarterly, April and July, 1906, pp. 294.

Cyaniding Weathered Pyritic Tailing

By Herbert R. Edmands*

In a temporary leaching plant 2300 tons of highly acid tailing was profitably cyanided, an extraction of 88% being obtained. The tailing, in 400-ton lots, was well mixed with lime; screened to break up clayey lumps and a 40-day treatment given.

*Edmands & Gidney, Metallurgists, Menzies, Western Australia.

The tailing on the dump of the Lady Gladys Co., Mulline, Western Australia, contained marcasite, blende, arsenical pyrite, and the decomposition products of these minerals. It had been exposed to the weather for three or four years and was exceedingly acid, giving off a sulphurous smell which was apparent for some distance from the dump. Although it had been sampled several times and pronounced quite untreatable except at a loss, it yielded a fair profit to my firm although we had to pay 10s. per ton for the dump. The dump contained 2300 tons of this material assaying 43s. 6d.; after treatment the residue assayed 5s. 4d. The bullion recovered realized, after paying bank and mint charges, £4377, or a little over 38s. per ton, practically all in gold, the silver being negligible.

Tailing Highly Acid

The average soluble acidity was 12.2 lb. CaO, and the total acidity 35.2 lb. per ton. The soluble acidity contained ferrous iron equal to 3.3 lb. Fe_2SO_4 per ton. A screen test gave the following: On 30 mesh, 2.8%; on 60 mesh, 29.4%; on 80 mesh, 13.1%; on 100 mesh, 8.6%; on 120 mesh, 7.1%; on 150 mesh, 4.7%; through 150 mesh, 33.4%. The portion passing 150 mesh was mostly a true clayey slime and contained a larger portion of acid and soluble iron than the sand portion. Had the tonnage been greater, classification and separate sand and slime treatment would have been better.

Owing to the limited tonnage, the plant had to be as simple and cheap as possible, but as long treatment was necessary the capacity could not be too small. Two leaching vats 40 ft. diameter, by 6 ft. deep, were erected each capable of containing 200 tons. The ground was first prepared for the bottoms by gradually sloping it from the circumference to the center, the fall being 10 in. From the center a large pipe conveyed the solution to the extractors. Light duck, sewed so as to form a circular surface, 41 ft. 6 in. in diameter, was thoroughly tarred and laid on the prepared ground thus forming the bottom. The sides were of 22-gage galvanized corrugated iron.

The bottom duck was turned up round a board, fastened to the bottom of the iron sides, to prevent escape of solution. The sides were stiffened by posts placed at intervals of 8 ft., the whole being encircled by three bands of old wire rope. The filter-bed support was formed of slats ⅝ in. square, placed 1⅛ in. apart, center to center, and resting directly on the tarred duck. These were kept in position by 1¼ x ¼-in. laths, tacked on top of the slats. The support was made in sections 5 ft. square, which were put in the vat with the slats pointing toward the center. The bottom was then covered with Hessian (burlap) and finally with 6 in. of rather coarse sand.

With such vats, which were mere filter beds with retaining walls, it was not possible to check the flow of solution, which was great at times, yet the precipitation averaged 65%. No solution was lost by leakage. These vats were afterwards used for treating another parcel of ore and at the end of two years' use showed absolutely no deterioration as far as the duck bottom and filter bed were concerned, although the iron sides were eaten through in many places. Such a plant, however, could only be justified by the special circumstances.

Preliminary Wash Not Profitable

Tests showed that although so much soluble acidity was present little was to be gained by a preliminary wash. The extraction was more rapid at first, but soon fell off and the total time of treatment was not greatly shortened. Moreover, a preliminary wash involved the use of soda for subsequent neutralization of the "latent" acidity, as lime could not be mixed sufficiently intimately with the wet sand. In any case it necessitated another handling. The use of soda was too costly, and was objectionable for other reasons, as will be seen later.

The main feature in the successful treatment consisted in first adding about 50 lb. of slaked lime per ton, which had to be thoroughly mixed, and then passing the mixture through a ½-in. screen, all slime lumps being broken up. After charging the vat with this mixture the next step was to wash with water or barren solution. The first wash always came off slightly alkaline. The original sand contained about 3.3 lb. Fe_2SO_4 per ton, which was now converted into ferrous hydrate. It was necessary to thoroughly oxidize this to the ferric state, otherwise the destruction of 8.1 lb. of KCN would result. Oxidation was accomplished by giving a succession of washes and draining between each wash. All wash water was well aerated, air being admitted into the suction of the centrifugal pump used, but the greater part of the oxygen supplied was contained in the drained sand, which was for the most part forced downward through the charge by each succeeding wash. It was estimated that a wash of 31 tons would contain about 0.4 lb. oxygen in solution, but the drained sand would contain about 14 lb. oxygen most of which would be forced downwards through the charge. The washing occupied four to five days, about ½ ton of solution per ton of sand being used. In some cases 1 lb. of lead acetate per ton of sand was added to the wash water, but without marked benefit.

A 40-Day Treatment Given

The sand now being well oxidized, about 50 to 80 tons of 0.05% cyanide solution were pumped on the 400 tons of sand daily. A 40-day treatment was generally required, the total solution used amounting to 6 tons per ton of sand, exclusive of wash water for oxidizing.

The solution carried gold in amounts varying from 18 to 20s. per ton at the commencement to 1s. or less at the end of the treatment. The cyanide consumption was a little under 4 lb. NaCN per ton. Notwithstanding the long time occupied in treatment the cost was not unduly high, as after the vats had been filled only one man was required to attend to the pumping, testing and assaying of solutions.

Before the treatment described was adopted the first charges treated threatened total failure. To these vats only 16 lb. of lime were added, the mixture was imperfect, and it was not screened. The idea was to wash out some of the soluble acidity and then complete the neutralization with caustic soda. The first wash came off showing soluble acidity equal to about 7.6 lb. Na_2O per ton of solution; this with succeeding washes was thrown away until the acidity had fallen to 1.5 lb. Na_2O. The wash was then neutralized with lime, soda added and the solution returned to the vats. A large amount of pumping was required; much time was expended, an additional 34 lb. of lime and 34 lb. of caustic soda were consumed per ton, bringing the total amount of lime up to 50 lb. and of soda 34 lb., which was more than twice the amount called for by the usual "total acidity" test.

Upon investigation it was found that on this class of ore the "total acidity"

test, (shaking a weighed quantity of ore with a measured volume of alkaline solution of known strength and noting the amount of alkali consumed) gave varying results, depending on the quantity or strength of alkali used and also on the time of contact. The accompanying examples show the effect of long contact in increasing the alkali consumption. The tests were made on ore from both vats at different depths which had already been partially neutralized. Samples of 112 grams each were shaken with 200 c.c. of 1% Na_2O, and the consumption of alkali noted after one hour's contact and after standing 15 days.

TESTS FOR CONSUMPTION OF ALKALI

"A" Vat Depth	Pounds of Na_2O Consumed per Ton After 1 hr.	After 15 days
0 to 1 ft.	3.76	17.92
1 to 2 ft.	3.04	37.76
2 to 3 ft.	15.84	33.20
3 to 4 ft.	24.40	37.72
4 to 5 ft.	26.64	36.64
Average	14.7	32.6
"B" Vat Depth		
0 to 1 ft.	1.24	15.04
1 to 2 ft.	0.96	13.84
2 to 3 ft.	2.00	16.88
3 to 4 ft.	10.80	24.48
4 to 5 ft.	20.80	34.40
Average	7.2	20.9

These tests show clearly that much alkali is consumed beyond that required to neutralize the sand if sufficient time be given, one of the chief reasons being the solution of considerable amounts of sulphur.

The presence of alkaline sulphides was never detected in the solutions coming from the vats but thiosulphates were present in quantity. Probably alkaline sulphides were first formed and were immediately oxidized to thiosulphates, etc. Alkaline sulphides could be detected in the above bottle tests that had stood for 15 days, as there was little chance for oxidation.

Several 112-gram samples of "Gladys" sand were each agitated with 200 c.c. of a solution of either caustic or carbonate of soda of a strength equivalent to 1% Na_2O. The consumption with the caustic solution after 1 hr. was 18.8 lb. per ton; after 20 hr., 20.96 lb.; after 72 hr., 25.6 lb. With the carbonate solution the consumption at the end of 1 hr. was 9.44 lb.; after 20 hr., 9.44 lb.; after 72 hr., 11.6 lb. per ton.

The caustic gave a colored solution and settled well; the solution contained alkaline sulphide. The carbonate gave a colorless solution and did not settle so rapidly; the solution contained no alkaline sulphide. These tests seem to show that when soda must be used the carbonate is better than the caustic alkali.

It was noted that with neutralization with caustic soda there was apparently a much greater oxidation of the ore than was the case when lime was used. When the treated ore was discharged from the vats its color was distinctly changed from yellowish to red or warm brown. This did not happen, at least to anything like the same extent, with lime-neutralized sand. The color imparted to the solution was also characteristic of caustic-soda neutralization, which became a dingy brown and which persisted throughout the whole cyanide treatment of that particular parcel.

According to Julian[1], "pyrite is much more soluble in cyanide solutions when a large excess of oxygen is present; with an excess of oxygen the pyrite caused the solution to become colored varying in shade from amber to muddy brown; the brown solution was found to have lost much of its dissolving power on gold and silver but the power was easily restored by the use of desulphurizing and oxidizing agents." From this it would be inferred that the solution of the pyrite with consequent coloring of the solution and loss of dissolving power was caused by the action of KCN solution in presence of excess of oxygen, whereas I found it to be caused by the action of an excess of NaOH in the presence of an excess of oxygen and that the same ore if neutralized with lime gave no such solution.

Constituents of Brown Solution

The brown solution contained 0.36% $Na_2S_2O_3+5H_2O$, some thiocyanate and the merest trace of ferrocyanide. After aeration it was as effective as colorless solution in dissolving gold, but the addition of permanganate or ferricyanide decidedly impaired its solvent activity for gold. Why this should be so was not clearly established. It was found that the addition of sodium thiosulphate to a pure cyanide solution increased its solvent activity, and of course the addition of permanganate or ferricyanide would destroy the thiosulphate, but this explanation is not altogether satisfactory.

While the addition of "hypo" to a cyanide solution gave increased solvent activity on immersed strips of gold, yet its advantage in practical work is at least doubtful. Leaching and percolation tests were made on other ores with and without the addition of "hypo" but the results were discordant. In the leaching tests there was no great difference, but the plain cyanide gave rather better results; in bottle tests the results varied. The tests were made on ores containing copper as carbonate and sulphide.

Julian shows[2] the great loss of dissolving power if the same solution is successively passed over several vats of ore containing pyrite and marcasite, and I noticed the same effect when the brown solution was passed several times over the ore without running it through the zinc boxes. Zinc apparently has some power of restoring the solvent activity which mere aeration has not. I have no explanation to offer but the effect was very marked.

After the initial trouble with soda, there was no difficulty in getting neutralization with an intimate mixture of lime and as already stated the amount of hypo formed increased with the amount of lime added, but the best work was done if the lime was not in large excess.

Methods of Testing

The ordinary test for reducing power, which consists of adding K_2MnO_4 to an acidified solution, is of no practical use for this type of solution. Solutions showing a high reducing power, owing to the presence of thiosulphates, may actually have a higher solvent activity than pure cyanide solutions of similar strength. The method adopted was to pass a current of air for two or three hours through the solution, testing it with permanganate in the usual way, and also testing solution which had not been so aerated, the difference giving the "active reducing power" which as a rule was exceedingly small or nil.

At the time this work was going on I knew of no published method for the estimation of thiosulphate in the presence of cyanide, so the following was adopted: Excess of lime was added to remove certain organic matter if present; 10 c.c. of the filtered solution was then taken and diluted with 50 c.c. of water and a slight excess of H_2SO_4 added (generally 2 c.c. of a mixture of 1 volume of strong acid with 2 volumes of water); this was then titrated with N/10 iodine, 1 cc. of iodine equalling 0.0248 grams of crystalline sodium thiosulphate.

Tests were made on "model" solutions containing "hypo," cyanide, thiocyanate, and ferrocyanide, and the test was found to be accurate to within 3% of the total "hypo," (more "hypo" being shown than was actually present) which was near enough for the purpose. If the solution were not sufficiently diluted the error was greater. Since that time Clennell in his "Cyanide Handbook" has given an almost identical method.

Topographic maps of two important mining camps have recently been issued by the U. S. Geological Survey. These are maps of Ray and vicinity, in Pinal County, Ariz., and of the Creede district, in Mineral County, Colo. The Ray map is on a large scale, 1:12,000, the contour interval being 25 ft.; the scale of the Creede map is 1:24,000. The topographic surveying of the area shown on the Ray map was done by W. M. Beaman and that on the Creede map by R. H. Reinecke, under the general direction of R. B. Marshall, chief geographer.

[1] "Cyaniding Gold and Silver Ores." First Edition, pp. 72 and 104.

[2] "Cyaniding Gold and Silver Ores," Chap. 10.

Northern California Gold Dredging

By Lewis H. Eddy

Three dredges, each of a different type, are operating in Siskiyou County in ground formerly worked by crude methods. One of these dredges uses a clam-shell bucket, another an orange-peel bucket, and the third the customary bucket elevator digging ladder. A fourth dredge of the latter type is about to go into commission on the Trinity River. The cleanup methods of the first two dredges are interesting.

Gold dredging in Siskiyou County, California, is active on Klamath River in the northwest and McAdams Creek in the central part of the county. Three types of dredges are employed, each especially designed for the particular character of the gravel and the topographical situation of the ground dredged. On Klamath River there are two dredges (a clam-shell and an orange-peel dredge): one operating in an old channel of the river at McConnell Bar; the other in the gravel and bedrock of the live stream at Hamburg Bar. On McAdams Creek a bucket-elevator California-type dredge operates in the old channel of the creek. There have been other attempts, and preparations are said to be making for still further dredging on the Klamath, where placer claims extend for several miles between the two points of present active operation.

Three Active Dredging Districts

The accompanying sketch map embraces a portion of the west half of Siskiyou County and includes the Klamath River and McAdams Creek dredging areas. It delineates Klamath River in its westerly and southwesterly flow from Humbug Creek to Scott River, the two points near which the shell dredges are operating; Humbug Creek as it flows northeasterly to the Klamath, and Scott River as it flows westerly and northerly to the Klamath; McAdams Creek channel and Cherry Creek flowing south to the Scott; and the present active dredging operations at McConnell Bar, Hamburg Bar and McAdams Creek. The prominent elevations are Humbug Mountain in the east and Scott Bar Mountain in the southeast. Yreka, the county capital and commercial *entrepot* is situated in the east; Fort Jones is south of McAdams Creek dredging ground; Scott Bar, an active placer mining camp is shown on Scott River in the west; and Hamburg Bar and McConnell Bar the extreme points of active dredging on the Klamath, one to the northwest, the other to the northeast part of the region mapped.

Active placer mining is practiced on the Klamath, Humbug and Scott, and quartz mining in the Humbug and Scott Bar Mountains and on the Klamath at Happy Camp. This mining territory, extending 40 miles east and west and 18 miles north and south geographically, is wholly without rail transportation facilities. The distances by wagon roads are in most districts approximately doubled by the various elevations, thus appreciably increasing the initial cost of installing mining machinery.

Yreka, the political capital of the county, situated in the eastern side of the territory mapped, has rail connection with Montague a distance of eight miles east, and stands approximately half way between San Francisco and Portland. This proximity to Oregon and Washington attracts capital from those states to the quartz mines; but the active dredging work is all done by California investors. Despite the isolation of this part of the county resultant from lack of interior rail transportation there is an air of prosperity and a strong faith expressed that the gold which escaped the crude methods of the early miners will be recovered by the modern methods now being introduced.

Dry-Land Clam-Shell Dredge on The Klamath

The dredging of the old river channel at McConnell Bar is operated by the Northern California Mining Co., H. G. Wellman, superintendent, with electrically driven machinery designed and constructed by the Wellman-Seaver-Morgan Co., of Cleveland. The equipment is composed of a clam-shell bucket, operated from a portable derrick standing on dry land at the edge of the dredged channel; a hydraulic giant; and three pumps. The purpose of this design and installation was to operate in ground that might not be economically handled with the bucket-elevator or other type of California dredge.

There are two gravel channels, covered by five placer claims, a total of 100 acres, of which 10 acres has been dredged in two years. These channels have an average depth of 45 ft. and maximum of 70 ft. The length of the cut described by the excavation is about 1800 ft., average width about 150 ft. The ground is broken down with a 3-in. giant under 125-lb. pressure. The gravel is lifted to the hopper with a 2½-cu. yd. cast-steel clam-shell bucket, weighing 13,000 lb. The boom is 126 ft. long, 18 in. square, in one piece of Oregon fir. The derrick frame is built of the same wood in parts of proportional dimensions, the base timbers being about 22 in. square; the whole, with its machinery equipment, resting on 8-in. rollers similar to those employed in the ordinary house-moving. As the excavation is advanced the derrick is moved by its operating machinery toward the "dead-man" to which it is anchored; the dead-man being reset as required.

Serpentine Bedrock

The bedrock, a compact serpentine having occasional soft spots, after being stripped by the machine shovel, is cleaned by hand with pick and shovel and hand scraper and brush; the soft places being dug to a maximum depth of about 12 in. The bedrock material is shoveled into tubs and dumped into the flume by an ordinary derrick. The water in the pit accumulated from the giant, and a proportion of the sand, is pumped out. The hopper into which the machine bucket dumps is equipped with an iron-rail grizzly, which separates the heavy rocks from the finer material, and the rocks are removed with an ordinary 4-ft. tub about 10 in. deep; the finer material being run to an ordinary 4-ft. wooden flume with Hungarian riffles for a length of 150 ft., and bottomed for a further length of 400 ft. with pine blocks 9 in. deep and about 12 in. square. The flume is situated between the dredged channel and the river, standing approximately parallel with the river into which it empties the water. As the advancement of the excavation requires the forwarding of the machine derrick the receiving end of the flume is extended by additional construction, and a new hopper is built. The bucket handles about 1200 cu.yd. in 24 hours; the small derrick on the bedrock delivers about 50 cu.yd. per day.

Most of Gold Near Bedrock

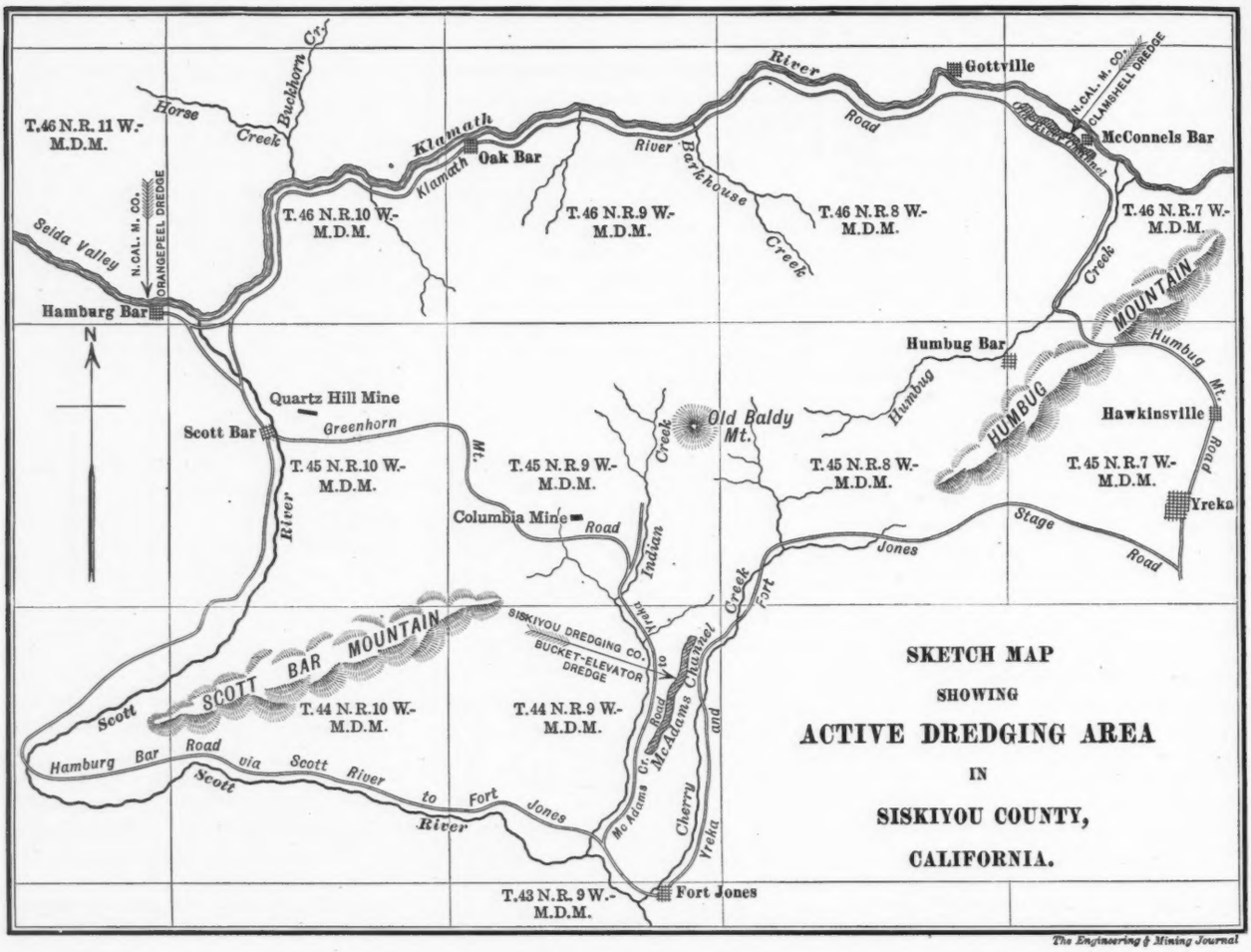
Seventy-five per cent. of the gold is recovered from within two feet of the bedrock. The bedrock material is said to yield about $1 per cu.yd., and the gravel delivered by the bucket 10 to 15c. per cu.yd. An average of the cost of handling the entire output was not obtainable, but the cost of recovery from bedrock by the hand method is about 90c. per cu.yd. The excavation so far has disclosed two channels, one deep, the other higher up. The best grade of material is found in the higher channel and on the rims. These channels are irregular in course, but gen-

erally run nearly north and south, approximately paralleling the river.

The ground was prospected with a Keystone drill, the best ground being found to lie next to the live-stream shore. About 60 acres of the 100 have so far been proven of dredgeable grade. By advancing the excavation 2000 ft. further, making a total length of nearly 4000 ft., the cut may be extended to the stream. It is the purpose to turn the stream into the excavated channel; and to prospect the bed of the present live stream in the vicinity of the mouth of Humbug Creek which flows into the Klamath at a point about 1000 ft. miles west from Yreka, and distant 10 miles by good wagon road over Humbug Mountain along the westerly side of Humbug Creek. The machinery for the plant of the northern California Mining Company was wagon-hauled over this road; the timbers for derrick construction, with the exception of the boom, were formed in a raft and floated down the Klamath from Hornbrook; the boom was floated from the same point separately.

The derrick machinery is operated by a 100-hp. Westinghouse 2200-volt A. C. motor. The hydraulic giant is supplied with water by a 12-in. Worthington centrifugal pump driven by a 100-hp. motor; the water for the big flume is supplied by a 20-in. Samson pump requiring about 150 hp. The water in the pit is pumped out with a Krogh 8-in. sand and gravel pump. Electric power is furnished by the Siskiyou Electric Power Co., over a pole line from a branch power station 18 miles south on Fall Creek.

bank of Klamath River measures about 32 miles, and covers some heavy grades. The road is in places approximately level with the river bank, but for the greater length it is several hundred feet above the river. Between these two points of active dredging the river placers have been and some are being worked in the vicinity of Oak Bar. A steam shovel was operated on the north side of the river with some success, and the China-pump device has also been employed. Hydraulic elevators have been contemplated by A. C. Aiken at Daggett ranch, and others. The Pine Grove placer is being worked at Oak Bar by G. Barton, and



southerly from the point at which the river stream is to be diverted.

In the early days of placer mining Humbug Bar gave high yields, and like other placer regions was by no means cleaned by the crude methods then employed. Humbug Creek flows in a northeasterly course for a distance of about 10 sectional miles, having its source at a point westerly from Humbug Mountain and about half way between that mountain and Mt. Baldy. It is the most important creek east of Scott River.

McConnell Bar is situate geographically about seven miles north and two

Operations at Hamburg Bar

Hamburg Bar is situated 10 miles west and 6 miles south, measured by sectional miles, from McConnell Bar, while the wagon road which skirts the southerly on Barkhouse Creek the Siskiyou Mines Co. contemplates extensive hydraulic operations.

The possibility of economical dredging in these districts evidently has not been seriously or practically considered, possibly due somewhat to the small publicity given to the dredging operations in this section, and to lack of study of the various dredging devices that have been introduced. There appears to be a constant effort to improve upon the obsolete methods of the early days; but the modern methods of handling gravel and devices for saving the gold have not been

generally considered. The demonstrations at Hamburg and McConnell have amply proved the mechanical practicability of handling both dry and stream gravel; whether or not these methods are largely profitable is a matter of concern to the companies themselves, which they are not disposed to make public. The impression, therefore, obtains in this section of the county that they are not profitable; but the operations continue.

The Northern California Dredging Co., J. C. Hampton superintendent, has been operating in the stream of Klamath River at Hamburg Bar for the last three years, averaging seven months in the year, beginning in April or May, dependent on the height of the water. The plant is composed of a floating boat, equipped with an orange-peel bucket, suction pump, and diving apparatus. The entire plant is driven by steam generated with wood fuel. The geographical situation of Hamburg Bar is 13 miles west and 4 miles north, by sectional measurement, from Yreka; the wagon-road distance via Klamath River is 42 miles; by the McAdams Creek and Scott River roads, 53 miles.

The situation of the stream placers at Hamburg in relation to the point of confluence of Scott River with the Klamath is similar to that of the McConnell Bar old channel in its relation to the point of confluence of Humbug Creek with the Klamath. At the latter point the Klamath makes a sharp turn from southwest to northwest; and at Scott River a more abrupt change in course is from almost due south and southwest to west.

Scott River, like Hamburg Creek, has been a large producer of placer gold, and there are still important operations in the placer-mining season. For a distance of 15 miles the course of Scott River in its flow to the Klamath is first northeasterly and then northwesterly. The dredging at Hamburg is toward the mouth of the Scott, as the operation at McConnell is toward the mouth of Humbug. Both are directed toward the point where a considerable deposit of placer gold may be expected; and in each case the river bed at the objective point will be thoroughly prospected; but at Scott River the prospecting will be done in the stream, as it is now done at Hamburg.

An Orange Peel and Suction Dredge

The operations of the Northern California Dredging Co. have extended three-quarters of a mile; the river in this length has a maximum width of 200 ft. and minimum 115 ft., which approximately describes the area of river bed dredged. This company and other locators have the stream located with placer claims from Scott River for a length of about 15 miles in a northwesterly course, thence southerly for 10 miles. The method of prospecting practiced by the company precludes the securing of practical data until the boat is installed on the located claim; except where there are bars or banks that may be prospected with the pan or drill. When the boat is installed at the desired point of operation it is anchored, with cables run to the shore, at the down-stream end of the area surveyed and platted for prospecting.

The bucket is a 21-cu.ft. Hayward orange-peel type, 7 ft. 9 in. high when closed and 6 ft. 4 in. diameter when open; operated with a 27-ft. boom equipped to dig 60 ft. below the water line; the maximum depth here required has not exceeded 27 ft.; the average mean depth of stream is about 5 ft. Following the line of the survey across the river the heavy rocks are cleared out with the bucket. This is followed by digging a ditch to bedrock across the river, the gravel being thoroughly prospected. The areas of the river bed thus shown to contain gold-bearing gravel are then stripped and extended up stream. This is followed up by the diver and suction pump to clean the bedrock. These areas are extended such distances as may be determined by the survey and the reach of the boom. Should one side or any part of the river disclose material foo low grade to be economically handled, the stripping and cleaning are confined to the producing areas, to the point predetermined by the survey. The same methodical process of prospecting and dredging is repeated until the claim or claims determined fail to produce gold-bearing gravel in commercial quantity. Then the boat may be floated to another district or section of claims.

Work Requires two Divers

The yardage capacity of the plant is an average of 500 cu.yd in a 9-hour day; the divers working 5-hour and 4-hour shifts. The labor requires, in addition to the two divers, an engineer, a fireman, a deckhand and the superintendent, a total of six. The boat is 100 ft. long, 35 ft. wide, and 25 ft. high over all; hull 5 ft. deep; displacement 125 tons. The suction pump is a 10-in. DuBois type, especially designed for pumping gravel. The engine is a 10x15x10-in. compound condensing Westinghouse; the boiler, 105 hp.; wood fuel is used at a cost of $5.50 per cord delivered. Considering the geographical situation of the placers being dredged, wood is the most economical fuel, and probably the only generator of power that could be used profitably. Electricity already installed is unquestionably cheaper than steam generated with wood fuel; but the expense of constructing an overhead pole line from Hornbrook, the most economical point, a distance of 51 miles over rough country, or from McConnel Bar, a pole-line distance of 25 miles, would be prohibitive.

The flume is built within the boathouse; it is 30 in. wide, 18 in. deep, equipped with Hungarian riffles of 2¼-in. angle iron. The gravel being separated from the heavy rocks by the initial work of the bucket, goes direct from the hopper to the sluice flume; a small canvas plant handles the black sand. The yield from the gravel washed is not made public, nor the cost per yard for operating.

Operations on McAdams Creek

The situation of McAdams Creek channel is about five miles north of Fort Jones and 18 miles by wagon road over Cherry Hill, southwest from Yreka. It lies between Cherry Hill and Scott Bar Mountain and is approximately parallel with Cherry Creek, a live stream. There are active and profitable quartz mines on either side, at elevations of 2000 to 5000 feet. The channel is a live stream only in the stormy seasons; in dry seasons it carries about 100 in. of water on the bedrock. The bedrock of the channel is decomposed slate; the gravel is a clean wash, medium coarse and carries no clay.

The early miners sunk shafts and drifted on the bedrock, throwing the heavy rocks out back of their workings. They did a large amount of work, and are reputed to have taken out a good deal of gold. These shafts varied in depth from 3 ft. to 22 ft. The pay must have been much more per cubic yard at that time than at present, as the methods of hand digging and hoisting with windlass could not have been profitably employed in gravel that can now be dredged at great profit. The Siskiyou Dredging Co. prospected the channel for a length of about two miles in its northeasterly and southwesterly course through T. 44 N., R. 9 W., M. D. M., and across an average width of 400 ft., with Keystone drills, sinking varying depths from 10 to 26 feet.

In February, 1910, the company installed a 5½-cu.ft. bucket-elevator dredge, designed by the Boston Machine Shop at Thermalito in Butte County, which is a branch of the Hammon dredge construction interests. The boat is 110 ft. long, 38 ft. 8 in. wide, hull 8 ft. deep; equipped with 81 Bucyrus type 5½-cu.ft., close-connected buckets, and belt conveyor, revolving screen and nozzle washing device. The machinery is driven by electric power furnished by the Siskiyou Electric Power & Light Co., whose main line extends across the northerly end of these claims. The electric current is brought over at 2080 volts for the digging-ladder motor, and transformed to

440 volts for the other motors. The digging motor is 100 hp. variable speed, winch motor, 20 hp. variable speed. All the other motors are constant speed; pump motor, 75 hp.; screen motor, 25 hp.; stacking motor, 20 hp.

In the 22 months ended November, 1911, the dredge turned over about 15 acres to an average depth of 40 ft. through the center of the channel and across a width of about 200 ft. in the southerly half of the claims, averaging 65,000 cu.yd. of gravel per month. The average value of the gravel is not made public, but in the richer portions of the channel runs as high as 15c. per cu.yd. There are 221 acres of ground in these channel claims, and 165 acres have been proven dredgeable. The estimated life of the hull of this dredge is about 12 years. Allowing for a decrease in the average depth of the ground and other physical contingencies the life of the boat approximately equals the probable life of the dredging field.

PERSONNEL OF SISKIYOU DREDGING CO.

The company was organized under the laws of the State of Maine and capitalized at $200,000. George J. Carr, field superintendent of the Yuba Consolidated Goldfields at Hammonton, is president; John J. Hamlyn, field superintendent of the Natomas Consolidated at Oroville, is vice-president; J. C. Osgood, San Francisco is secretary; J. W. Bole of Fort Jones is dredge superintendent. This company is not a part of the W. P. Hammon interests, but an independent concern owned by men, some of whom are in the employ of the Hammon interests. It is of interest to note that this is an independent company, organized by men of small means for the installation of a small-capacity dredge at a time when the advancement of dredging seemed to be demanding dredges of large capacity. The installation and profitable operation of this boat demonstrates the fact that gold dredging in California is not necessarily confined to large capital investment.

While a 15-cu.ft. dredge would dig an equal field in less than three years, or a saving of more than 75% in time occupied in earning an equal gross amount, with an equal expenditure for labor and an increase in cost of operation only in the power consumed, the investment in a larger dredge, would not be profitable for the reason that the excess life of the boat over the life of the field would have no value, without large expenditure for dismantling, moving and reinstallation. So the small boat is an economic investment in a limited field; and the limited field and small type of dredge offer opportunity to men of modest capital in other sections of Siskiyou and the northern counties. These small boats of 4 to 6 cu.ft. capacity are operating in several counties in limited territory, and are profitable investments.

SCOTT RIVER DREDGE REMOVED TO TRINITY

In the summer of 1908 the Scott River Dredging Co. installed a 7½-cu.ft., bucket-elevator dredge in T. 40 N., R. 8 W., M. D. M., on Scott River west of the town of Callahan. The company held about 200 acres of ground that had been drilled and shown to contain coarse wash gravel with no clay and but little sand. The dredge turned over 7½ acres in the first 12 months, averaging about 30 ft. deep, and outputting about 355,000 cu.yd. of gravel, or less than one-half the output of the 5½-cu.ft. dredge of the Siskiyou Dredging Co. The dredge was put out of commission in 1910, and the machinery was purchased by the Alta Bert Gold Dredging Co. in July, 1910, dismantled and hauled by team to Trinity Center in Trinity County 28 miles south, where it was reconstructed by the Union Construction Co. with a new hull, and some changes in design and equipment.

Originally the dredge was designed and constructed with a plate-girder digging ladder, 85 ft. 5 in. long, equipped with 72 close-connected buckets, weighing 2300 lb. each. The revolving screen was Risdon patent, and the gold-saving tables, the Holmes type; most of the remaining machinery was of the Link-Belt Co. make, while the hull was constructed and the machinery installed by the Western Engineering & Construction Co. The hull of this boat differed from the usual design of California type dredge, being 9 ft. deep at the bow and 5 ft. at the stern. In the reconstruction the boat is being adapted to the field on Trinity River, and was to have been ready for commission in December. It will be electrically driven with 250 to 350 hp., G. E. motors.

Burning Temperatures for Limestone

The maximum and minimum permissible temperatures for, and the physical changes involved in limestone burning have been the subjects of recent work by Bleininger and Emley.[1] The minimum temperature must of course be above the dissociation temperatures, which are found to be 880° C. for calcium carbonate, and 750° C. for magnesium carbonate. The proper burning temperature for a lime may be fixed by a study of its hydration and porosity curves at different temperatures. For pure limestones the maximum permissible temperature is over 1300° C., for impure limestones between 1050° C. and 1150° C.; for pure magnesium carbonate, between 1000 and 1050° C.; and for impure magnesium carbonate, 900 to 1020° Centigrade.

[1]Journ. Soc. Chem. Ind., Dec. 15, 1911.

Neutralization of Roaster Gases

The apparatus for the application of Sprague's method of neutralizing the SO_3 in smeltery smoke[1] is described in U. S. pat No. 992,391. The smeltery gases treated are those from converter roasters containing comparatively little SO_2, and those from reverberatory roasters containing large amounts. For the treatment of the former class a furnace is used consisting of a number of units each of which has a perforated grate for a bottom, upon which is placed a charge of finely ground zinc ore mixed with slack coal, through which a light blast is forced. The zinc oxide formed floats up and into the flues from the reverberatory roasters, where the SO_3 is completely neutralized. On account of the highly acid character of the reverberatory-roaster gas, it is uneconomical to attempt to neutralize with zinc oxide, so an apparatus is employed to feed finely ground lime into the fan handling these gases. This fan is provided with a small shaking feeder, by which pulverized lime is admitted on the suction side. The quantity of lime admitted can be varied according to the acidity of the gases treated.

While this is a much cheaper method of neutralizing than that by zinc oxide, the results are not complete, and the fumes from this fan should be driven into the flues from the converter roasters, where they will be completely neutralized by the remaining zinc oxide in the treated converter-roaster gases.

Uses of Zirconium

The extreme hardness of zirconium carbide renders it suitable for a polishing material and for cutting glass[2]. Zirconia makes a good insulator, and mixed with good conducting material, is used for electrical heating purposes. Pure zirconium oxide is a fine white powder which is suitable for the manufacture of white paint. It can also be used as a nonirritant dressing for the surface of wounds. It is also suggested because of its heat-resisting power that it be substituted for thorium nitrate in the mixture of thorium and yttrium salts used to glaze the iridium bars in the Heraeus iridium furnace.

[1]Eng. and Min. Journ., Mar. 5, 1910.
[2]Chem. Zeit., 1911, p. 1261.
Cf. Journ. Sc. Chem. Ind., 1901, p. 884; 1910, pp. 150, 218; 1911, pp. 210, 554.

Nevada-Utah Mines and Smelters Corporation

Attention was recently called to the affairs of the Nevada-Utah Mines & Smelters Corporation by the filing of the schedules in bankruptcy by the company, on Feb. 6, in the United States District Court, in New York. According to the schedule, the company's debts are as follows: Taxes due in Maine, $775; secured claims, $140,000, the largest of these being one for $92,500 of L. Vogelstein & Co. and one for $40,000 of the Bristol Consolidated Mining Co. The largest of the unsecured claims are: Paterson National Bank, Paterson, N. J., $7500, John W. Griggs, Paterson, N. J., $5000, C. J. Caughey, New York, $13,977, and others, bringing up the total to $44,258. In addition to these there are disputed claims amounting to about $180,000, of which the largest is a note for $125,000, held by the Merchants National Bank, of Salt Lake City. It is also shown that the subsidiary companies are indebted to others in an amount greater than $50,000, aside from certain disputed claims against these companies. The schedule of assets filed shows principally a large amount of debts due to the Nevada-Utah company from subsidiary companies on open accounts, and shown at their face value to be worth $307,743. There was cash on hand 86c., and deposits of money amounting to $274 in the banks and elsewhere.

Plan of Readjustment

Under date, Dec. 15, 1911, the stockholders were advised by circular of a plan of readjustment of the company's affairs. This plan has been superseded by one dated Feb. 26, 1912, in which it is stated that the existing indebtedness of the corporation and its subsidiary companies, after adjustment of certain claims, is about $230,000; the present stock outstanding amounts to $15,000,000 and consists of 1,500,000 shares, par $10. It is further stated that the plan outlined below will be carried into effect under the direction of Trippe & Co., as successors to T. Gross, who was named as the syndicate manager in the original plan.

It is proposed to form under the laws of the state of Delaware, or some other state, as may be selected, a corporation to be known as the Consolidated Nevada-Utah Co., which shall have certain authorized issues of capital stock and convertible bonds. The securities and properties now owned by the Nevada-Utah Mines & Smelters Corporation, will be conveyed to this company, and the new company in payment for these properties will issue its stocks and bonds in the amounts provided and distributed in the manner prescribed. It is stated that at the request of the syndicate managers, and of the directors of the Nevada-Utah company, Willard V. King, president of the Columbia Trust Co., L. Vogelstein, of L. Vogelstein & Co., of New York, and William D. Elwell, of Wiggin & Elwell, of Boston, have consented to select the personnel of the new company and its first board of directors.

Under this plan there are to be 2,000,000 shares of common capital stock, par $3, total $6,000,000; 900,000 of 6% first-mortgage, serial convertible bonds, payable $90,000 per year, commencing July 1, 1918, secured by stocks and first mortgages, covering the Nevada and Utah properties and convertible at any time into stock at par.

Purposes of New Issue

The new company will issue upon the order of the syndicate managers in payment for securities and properties purchased, 1,700,000 shares of its capital stock, and $900,000 of its bonds, the new company reserving 300,000 shares of stock to provide for the conversion of bonds.

The stock issue will be distributed as follows: 1,500,000 shares will go to the stockholders of the Nevada-Utah Mines & Smelters Corporation, who deposit their stock under this plan and take bonds to an amount equivalent at par to 50c. per share so deposited, one share of stock in the new company for each share deposited; 150,000 shares will go to the syndicate managers and to subscribers who have underwritten not less than $200,000 par value of the bonds of the new company, and 50,000 shares to the treasury of the new company, making the total of 1,700,000 shares. Of the bonds it has been arranged that $750,000 par value will be offered to the present stockholders of the Nevada-Utah company at par, before being sold or disposed of to others. The stockholders joining the plan must deposit with the Columbia Trust Co., on or before Mar. 31, 1912, the signed subscription agreement accompanied by their stock certificates and a check for 60% of the par value of the bonds being subscribed for; 20% of the par value of the bonds is due May 31, 1912, and the remainder, 20%, Sept. 30, 1912. In return a receipt will be given for each of the first two payments and the stock and bonds will be delivered on final payment and surrender of receipts. This will give each stockholder one share of new stock for each share of old stock so deposited, in addition to a 6% bond, or scrip, for the full amount paid, secured by a first lien on the property of the new company, and at his option convertible into stock at par.

Under this plan it is proposed to raise $750,000 cash, which will be distributed as follows: To holders of notes and other valid indebtedness of the Nevada-Utah company and its subsidiary companies, not exceeding approximately $230,000; for compensation of the syndicate managers and subscribers and for commissions, taxes, expenses of receivership and general readjustmnt expenses, not exceeding approximately $130,000; to the treasury of the new company, $390,000. Under the new plan, the outstanding securities will be as follows: Stock issued and outstanding, 1,650,000 shares, or $4,950,000; stock in treasury, 50,000 shares, or $150,000; stock reserved to provide for conversion of bonds, 300,000 shares, or $900,000; total, $6,000,000; convertible bonds issued and outstanding, $750,000; convertible bonds in treasury, $150,000; cash in treasury, approximately $390,000; other indebtedness, none.

It is said that arrangements have been made with the holders of the alleged claims against the company, aggregating over $165,000, for the adjustment of these claims in a manner favorable to the new company, and that the expenses of the readjustment will be materially reduced by these arrangements and other savings.

Other Plans

A committee known as the Stockholders' Protective Committee, of which Frank D. Pavey is chairman, has issued recently a circular under date of Feb. 29, in which still another plan is outlined for the reorganization of the corporation. In a circular accompanying the plan of the Pavey committee, certain objections are made to the plan of Trippe & Co. Following this, and under date of Mar. 11, Trippe & Co. have caused to be published a notice in which they state that all information in their possession affecting the reorganization of the company will be given to any stockholder, but that they do not intend to answer the statements contained in the Pavey circular; further, that the plan under which they, Trippe & Co., are acting, has the support of stockholders owning a large number of shares and that they have every reason to believe that their reorganization will be successfully completed.

It will be remembered that on July 31, 1911, E. R. Wooley, former president of the company, explained in a circular to the stockholders the benefits which the company was to derive by combining the Pioche properties in the Amalgamated Pioche Mines & Smelters Corporation, and terminating the dispute and litigation in which the camp was involved. It was stated in the circulars of Dec. 15, 1911, that the present board of directors considers that this combination was desirable and of benefit to the company, but that it cannot approve all the methods employed by the former management to accomplish this end, nor all of the transactions connected therewith, as to the

character and effect of which the former board, it is said, was not fully informed.

In December it was stated that the company's mines in Utah are being operated by lessees, and that the Day mine is being worked by the Day-Bristol Co. It is said that the Bristol mines cannot be operated profitably until the problem of transferring the ore to the railroad is solved. Further, considerable development is said to have been done on the Amalgamated company's properties with gratifying results, and this development, it is claimed, should be immediately pushed so that the extent and character of the orebodies may be determined, with a view of erecting suitable reduction works.

The Nevada-Utah Mines & Smelters Corporation has about 10,000 stockholders, and this wide distribution of the stock has caused a considerable interest to be manifested in the affairs of the company since they were first brought into prominence, recently, by the circulars issued in the summer of 1911 by E. R. Wooley, then president.

Premier Diamond Mine

JOHANNESBURG CORRESPONDENCE

The 1911 report of the Premier Diamond mine, in the Transvaal, shows that 8,325,000 loads, each of 16 cu.ft., of blue ground were crushed and washed. This is a reduction of 1,000,000 loads from 1910. The value per load recovered was 3s. 5.3d. against 3s. 2.5d. in 1910, but the yield per carat per load was only 0.213 against 0.230 in 1910. The reduction in grade apparently continues each year with depth and presents a serious problem. The increased value of yield was due solely to an advance of 15% in the value of stones won, and this was due to the recent rise in the diamond market. Every 24 hours 29,055 loads are treated. The cost per load in 1911 was 2s. 0.99d. and the cost per carat was 9s. 9.3d. The total yield of diamonds was 1,774,206 carats, a decrease of 371,617 carats from the previous year.

Operations were hampered by the removal of 740,022 tons of "floating reef," a waste rock broken from the walls and inclosed in the blue ground. Another 750,000 tons remain to be removed. Shortage of native labor accounts for the reduced scale of operations; the profits were £531,276, of which dividends absorbed £300,000; diamonds on hand are valued at £311,367. The recruiting of 12,169 natives cost £40,836 or 67s. per head, whereas in 1910 recruiting cost only 34s. 10d. per head.

In some of the gold mines of the Rand natives were recently costing £5 per head to recruit and compound, and recruiting costs have risen to 1s. 3d. per head per shift. At the Premier, natives find their own food and are paid an average of 2s. 8.7d. per shift. A total of 729 whites were employed, £209,123 being paid in salaries and wages.

The Premier mine has yielded £5,541,975 in profits; of this the equipment has cost £1,646,665. The government of the Transvaal has taken £1,675,785 and dividends to shareholders have absorbed £1,420,000; diamonds in hand amounted to £400,000; trading, reserve funds and cash balance have absorbed the remainder.

South African Notes

JOHANNESBURG CORRESPONDENCE

The year 1911 has been a disastrous one for shareholders in Rhodesian and Congo stocks. The shares in the Chartered Co., which administers Rhodesia, have fallen £1,309,158 in value; Tanganyikas, which own four-tenths of the Congo copper mines, fell £1,702,196; Globe & Phoenix, the show mine of Rhodesia, is down £700,000 in valuation. The Shamva mines, the coming hope of Rhodesia, have lost £406,000; "Eldorados" fell £281,000, and owing to the approaching exhaustion of all its known orebodies, "Giants" lost £196,000. Rhodesia dividends for 1911 totaled £954,613. One of the oldest and most noted mines in Rhodesia, the Surprise, which originally showed 4500 ft. of profitable oreshoot, has been let to leasers owing to unsatisfactory developments.

The Consolidated Langlaagte is one of the Rand's few coming mines. The older portion of the mine has been worked successfully for many years; a new mine is being developed south of a large longitudinal dike which caused an upthrow of nearly 1000 ft., and a new mill of 200 stamps is being erected. In the new mine there are 930,572 tons of profitable ore assaying 8.71 dwt fully developed, and 453,992 tons developed assaying 2.43 dwt. In this mine so much gold occurs in the quartzite partings between the banket-pebble leaders, that sorting waste is impossible and all mine rock is milled.

NOTICE FOR MEETINGS INSUFFICIENT

At the recent meeting of the Randfontein Central, unfavorable comment was made on the fact that only one week's notice of meeting was given, thus rendering it impossible for European shareholders to investigate the reports or to criticize or be represented in any way. A strong agitation has grown up, to have annual meetings transferred to London, and as a compromise several groups have agreed to defer date of meetings some months after the annual reports are published, to enable foreign shareholders to take any action they wish. Most annual meetings held in Johannesburg have been merely formal affairs.

The affairs of the East Rand Proprietary mines still afford a topic of discussion. The "Corner House" has decided, if possible, to take over the real direction of affairs and to allow the author of the present state of affairs to remain as chairman, as an impotent figurehead. The chairman of the Randfontein Central Mines, which is an amalgamation of all the Randfontein mines, reported that during 1911, 745 stamps, out of 1000 erected, crushed 2,159,032 tons for a yield of £2,661,280, or 24s. 7.8d. per ton, while working costs were surprisingly low, being 16s. 8d. per ton. The gross profit was £854,241. He stated that there was a shortage of 5000 natives and that the percentage of sorting has dropped to 5.61%, being another example of the policy of milling waste to make a show of keeping costs down and stamps running, and hence the grade was below the average. The payable reserves total 5,658,859 tons, assaying 7.29 dwt., with 1,000,000 tons assaying 2.83 dwt. He stated that the full requirements of the Rand mines were 297,000 natives, and that there was a shortage of 34½%, whereas last year the shortage was 29%. Recruiting, however, has been better recently, one group having practically all the labor necessary and owing to a dry season good results are expected for the coming year. There is, however, some danger of a great shortage of water for milling and domestic purposes next winter, owing to the shortage of rainfall this season to date. The government figures show for 1911, 24,344 whites and 189,259 colored workers employed at the Rand mines.

GOVERNMENT STATISTICS

The government mineral statistics have been issued. In the Transvaal, 24,456,871 tons were milled for £34,991,620 and a gross profit of £11,725,870. In the Witwatersrand district, 23,888,258 tons were milled for £23,542,479, there being 9432 stamps and 216 tube mills at work. The yield was 27s. 11d. per ton, or 7d. less than in 1910, and costs 18s. per ton, or 5d. more than in 1910. The gross profit was 9s. 7d. per ton, or 11d. less than in 1910, a total of £11,415,861. Practically 490,000 tons were crushed for an extra profit of £200,000. Dividends totaled £7,763,086. Tin-ore production showed a decline of £14,000 to £314,021, due to exhaustion of the Groenfontein tin mines and of the Swazieland tin fields.

Mineral Production of Quebec, 1911

The preliminary estimates of the 1911 mineral production of the province of Quebec show an increase in value from $7,323,281 in 1910 to $8,567,143 in 1911. The most valuable item on the list is asbestos, 99,352 tons, $2,939,006; followed by cement 588,283 bbl., $1,931,181; bricks, 130.297 M., $1,135,501; limestone, $1,081,059; granite, $308,545; lime, $284,334; copper and sulphur ore, 38,554 tons,

$240,097; marble $143,457; gold, 590 oz. and silver 23,000 oz., valued together at $23,300; and other miscellaneous products amounting to $480,663. The average value of asbestos declined during the year from $33.09 to $29.58, owing to overproduction, but the industry is now in satisfactory condition. Stocks fell from 41,159 tons on Jan. 1, 1911 to 31,420 tons on Jan. 1, 1912. Most of the copper ore comes from the McDonald mine, but the Eustis Mining Co., and the Ives mines near Eastman also contributed. The entire silver production and part of the gold comes from these copper ores.

Investigation of Alleged Smelting Trust

WASHINGTON CORRESPONDENCE

On receiving from the House of Representatives the Martin resolution relating to the smelting industry, and inquiring what information the Department of Justice has in its possession with reference to the existence of a smelting trust, Attorney-General Wickersham last week gave to the press a statement, in which he said that a year or more ago he instituted a careful inquiry into the smelting situation and found that the various companies were actively in competition with one another and that there was no reason to believe in the existence of a trust, such as has been charged.

The statement was followed by a communication from the Attorney-General to the House in official form, conveying the same information with greater detail. Attorney-General Wickersham called attention to the methods he had followed in his inquiry, and practically expressed the opinion that there was no basis for action concerning the trust. His reply is as follows:

In reply I am directed by the President to state:

(1) The Department of Justice has no evidence in its possession of the existence of a smelter trust in the United States in violation of the act approved July 2, 1890, entitled "An act to protect trade and commerce against unlawful restraints and monopolies and acts amendatory thereof."

(2) The Department of Justice has in its possession no evidence that the American Smelting & Refining Co. constitutes in itself a trust or any part of a trust in violation of said act and acts amendatory thereof.

(3) Some complaints have been made to the department touching the operation of the American Smelting & Refining Co. as the same might be affected by the antitrust act. One complaint bearing on that subject was made some months ago and was referred to the United States attorney for the Southern District of New York for investigation. That official subsequently reported to the department that he had conducted an investigation before a grand jury in his district in June, 1911, for the purpose of ascertaining whether or not there existed a combination between the American Smelting & Refining Co., the Federal Mining & Smelting Co. and the United Verde Copper Co. in the form of an agreement between those companies made in the latter part of 1910 providing for a limitation of their output or a fixing of the price, and that after examining the officers and books of the companies and other witnesses he was unable to find evidence of the existence of such an agreement.

(4) It is not considered compatible with the public interests to state what other, if any, steps have been taken to investigate the existence of any smelting trust.

Representative Martin, the author of the resolution, since hearing from the Attorney-General, has expressed the intention of drawing up a resolution calling for a Congressional investigation of the alleged smelting trust and requiring also an investigation of the reasons why Attorney-General Wickersham reached the conclusions he did and the circumstances under which his investigation was carried on.

Mason Valley Mines

The second annual report of the Mason Valley Mines Co., covering the year ended Dec. 31, 1911, shows that the year has been one of progress for the company. President Thompson states that to date, with one blast furnace in commission since January, 1912, matte containing over 1,824,000 lb. of copper has been produced. Custom ores are being received daily and this business is expected to increase steadily.

ADDITIONAL EQUIPMENT

Much new equipment was added during the year at the mines. This includes: An Ingersoll duplex compressor, with a capacity of 1216 cu.ft. of free air at 100-lb. pressure, driven by a General Electric 200-hp. induction motor. The present arrangement of the two compressors makes it possible to use either or both as required. Six additional Waugh drills were purchased, making a total of 12. Electric haulage has been installed throughout No. 4 tunnel level, this equipment consisting of one 4-ton Jeffrey locomotive and one 25-kw., 250-volt, direct-current generator. Twelve 2-ton ore cars were provided for ore haulage. A crushing plant was installed in the upper terminal building in which is a Blake-type jaw crusher with a 15x30-in. opening. A belt-conveying system, driven by a 50-hp. induction motor, transports the ore from the crusher to the orebins. The aërial tramway is the Otto friction-grip system; it is 6250 ft. long and has a capacity of 100 tons per hr. All mine machinery is operated by electric power purchased from the Truckee River General Electric Company.

Development work during the year has been confined principally to equipping the mine and preparing the necessary chutes, raises, crosscuts, etc., for the economical handling of ore. Drifting for the year amounted to 451 ft.; crosscutting, 491 ft.; raises, 1326 ft., total; 2268 ft. The total amount of tunnels and drifts is now 9466 ft.; crosscuts, 2856 ft.; winzes and shafts, 371 ft.; raises, 2443 ft.; total openings, 15,136 ft. Several hundred feet of diamond drilling done in the North Excelsior claim gave encouraging results and are said to warrant continuing the work.

The mine is being worked by the shrinkage-stope system. After being mined, all ore and limestone are delivered through chutes to ore pockets in No. 4 tunnel level, from whence it is transported, crushed, and carried by aërial tram to the loading terminal near Mason.

WATER

Water for smelting and domestic purposes is secured from several sources all situated on the smeltery property near Thompson. Two hot springs with a combined flow of 40 gal. per min, are one mile east of the smeltery, and by electric pumping supply water to the smeltery. Two flowing wells have also been developed; one is 300 ft. deep and flows 20 gal. per min. and one at 550 ft. flows 120 gal per min. These are 6500 ft. south of the smeltery and the water is pumped to the storage reservoir by electric pumps. A shaft well sunk to 40 ft. depth developed 70 gal. per min.; this is now available but not in use. Water rights have been secured covering the use of the water in a slough extending for two miles across the property. The Gregory ranch property controls valuable water rights from the Walker River.

A large concrete storage reservoir, holding 300,000 gal. has been constructed at a point sufficiently high to provide gravity pressure for circulation. All water from springs and wells is run into this and the circulating water from the furnaces, transformers and compressor is pumped back to the reservoir, thus minimizing losses.

The new smeltery, begun in November, 1910, was completed about Jan. 1, 1912, and the first furnace was successfully blown in on Jan. 6, as recently described in the columns of the JOURNAL.

SINTERING PLANT

A Dwight & Lloyd sintering machine has been installed and will be used in sintering ore fines, concentrates and flue dust. A disk-cable conveyor takes the flue dust from the dust chamber, a distance of about 300 ft. to this sintering machine.

The report shows total current assets, Dec. 31, 1911, $229,035, as against $147,449, total current liabilities.

The exportation of cryolite (Na_3AlF_6) from Greenland in 1910 was about 6000 metric tons (*Journ. Four Elect.*, Jan. 15, 1912) of which only a few tons came to the United States.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

T. A. Rickard, of London, is in San Francisco.

W. C. DeCamp is at Creede, Colo., in charge of the Creede Triune mines.

Oscar H. Reinholt is now at Pasadena, Calif., and is acting as secretary to C. H. Merritt.

Edward W. Rabb is confined to his bed at Denver, Colo., with an attack of appendicitis.

C. W. Purington has terminated his connection with the Orsk Goldfields, Ltd., in Russia.

William H. Hendrickson is now manager for the Horn Silver Mining Co. at Frisco, Utah.

Julius H. Barnes, of Duluth, Minn., recently made an examination of the Keating mine, in Montana.

Timothy W. Sprague recently returned to Boston from a trip to Colorado on professional business.

Kirby Thomas has returned to New York after a six weeks' trip to Missouri, Arizona and Mexico.

E. C. Felton, president of the Pennsylvania Steel Co., has returned from a trip to the company's mines in Cuba.

Joseph E. Gay, president of the various Stanton copper properties, on Mar. 11, celebrated his 80th birthday in the best of health.

D'Arcy Weatherbe has become a partner in the firm of Bainbridge, Seymour & Co., Salisbury House, London Wall, London, England.

Arthur Fallon, of Denver, Colo., recently made an examination of a low-grade gold deposit in Montana, not far from Virginia City.

Howland Bancroft left Denver March 16 for Los Angeles. After a short stay there he will go to Arizona, returning to Denver early in April.

Henry S. Fleming, for a number of years secretary of the Bituminous Coal Trade Association, has been chosen chairman in place of L. N. Lovell, deceased.

Robert E. Cranston has opened offices in the First National Bank Building, San Francisco, and is prepared to examine and report on mines or undertake their management.

Julian Kennedy, of Pittsburg, has been appointed consulting engineer for the Brier Hill Steel Co., Youngstown, Ohio., and will have charge of the erection of the new plant.

Paul Danckwardt has resigned as superintendent of the plant of the Black Hills Smelting Co., at Galena, S. D. It is reported that friction with the management of the company was the cause.

H. D. Glashan, of the Bureau of Water Resources of the U. S. Geological Survey, is making a trip through northern California obtaining data on water volume of the rivers and smaller streams.

Howard S. Smith, of San Francisco, returned from London on the "Mauretania" this week and proceeded to Austin, Nev., where he is to investigate the affairs of the Austin-Manhattan Mining Company.

John Curnow, superintendent of the Arizona Commercial Co.'s mines, at Clifton, Ariz., was badly injured, Mar. 6, by falling down the Yavapai shaft of the mine. At latest accounts he was slowly improving, but was still in a precarious condition.

J. N. Porter, who opened the first mine in the Iron River district, Menominee Range, and who for several years had charge of all of the mines in both the Iron River and Crystal Falls districts, has assumed charge of the mining operations of the Iron River Ore Co., at its recently opened Buchholtz mine.

F. C. King, for the past 3½ years assistant superintendent of the reduction division of the Cananea Consolidated Copper Co., at Cananea, Sonora, Mexico, has accepted a position on the mtealurgical staff of the Southern Department of the American Smelting & Refining Co., at Aguascalientes, Mexico.

Frank L. Crobaugh, Cleveland, Ohio, has disposed of that portion of his chemical business which consisted of the sampling and analyzing of iron ore in shipments for storage, for the purpose of adjustment between the buyer and seller, and will not hereafter have the organization for carrying on that class of business. He will continue, however, to operate as an analytical and metallurgical chemist.

Recently prominent officials and engineers of the Inspiration Consolidated Copper Co. have been visiting the company's mines in Arizona, the Inspiration and the Live Oak, and conferring on the plans for future development and construction. The party included W. B. Thompson, president of the Company; W. D. Thornton, vice-president; George E. Gunn, of the Gunn-Thompson Co.; W. H. Aldridge, acting manager; Dr. L. D. Ricketts, consulting engineer; C. H. Repath, consulting construction engineer, and J. L. Mauch, associated with Mr. Repath. Besides the above mentioned, were T. R. Drummond, local manager of the Inspiration mine; J. M. Callow, consulting metallurgical engineer, and F. J. Brule, construction engineer, who will have immediate charge of construction work. Mr. Thornton and Dr. Ricketts have returned to Cananea, and Messrs. Gunn and Thompson have gone to Superior to visit their Magma mine.

OBITUARY

Horace P. Wilcox, a mining engineer, of Hamilton, Ont., died in New York, Mar.13, aged 38 years. He was visiting New York on business.

John Dickey Culbertson died at Sewickley, Penn., Mar. 13, aged 67 years. He was born at Wheeling, W. Va., and had been engaged in the iron trade all his active life. He was for many years connected with the Riverside Iron Works, at Wheeling. For 13 years past he had been vice-president and treasurer of the National Tube Co. He left a widow and two sons.

Federico Stallforth died at Wiesbaden, Germany, Feb. 16. He was born in Germany and went to Mexico about 1860. In 1862 he settled at Parral, Chihuahua, and established the firm of Stallforth & Co., which grew up to be a large dealer in mining machinery and supplies and an important banking house. Some years ago he returned to Germany, leaving the business in charge of his nephews.

Francis Hendricks died in New York, Mar. 17, aged 74 years. He was born in New Jersey and passed all his active life in the copper business. He was a member of the firm of Hendricks Brothers, owners and operators of a copper rolling mill, at Belleville, N. J., which is the oldest plant of the kind in the United States, having been originally installed by his grandfather in connection with the old Schuyler mine—later known as the Arlington—at Arlington, across the Passaic River from Belleville.

George H. Turner, Torrington, Conn., vice-president of the American Brass Co., died in New York, Feb. 29. He was a native of Prince Edward Island and was about 45 years of age. Practically all of his business life was spent in the metal industry. He was at first associated with Wallace & Sons, Ansonia, Conn. When the factory of this firm was purchased by the Coe Brass Co., in 1895, Mr. Turner became connected with that company, where he continued until seven years ago, when he removed to Torrington. He became a strong factor in the business and held the office of secretary of the Coe Brass Co., and was a vice-president of the American Brass Co. since Jan. 1, 1912, when the subordinate companies were taken over by the holding company.

Societies and Technical Schools

American Institute of Mining Engineers—The New York section of the institute will hold a meeting at the Engineering Societies' Building, 29 West Thirty-ninth St., New York, on Tuesday, Mar. 26, 1912, at 8:15 p.m., at which Prof. James F. Kemp will present an illustrated lecture on "Iron Mines in Swedish Lapland."

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Mar. 14—Despite the large amount of oil in storage in California fields the prices for crude at the well are reported to have been increased both by the Standard and the Union to a minimum of 35c. per bbl., an increase of 5c. The offer was made tentatively by the Union, to the Independent Agency, to pay 35c., but the matter had not at last accounts been definitely settled. It is not unlikely that some of the members of the agency foresaw that the Standard must raise its price from the maximum of 30c. for low-gravity, and make a reasonable price for refining oil, which it has done. Whether the agency will take advantage of this and stand out for a price above 35c. from the Union, is not made known, but there is a strong inclination on the part of some of the members to demand 40c. An increase of 10c. on the price of the last year would enable the agency members to make a profit on investment and operation, and in order to continue production without risk of loss to many, that is as low as the price for California crude at the wells should be permitted to go.

Denver

Mar. 15—An additional flow of water has been developed in the deep drainage tunnel and it is thought that the Gold Dollar vein system has been opened. It was struck in a formation of disintegrated granite within the lines of the St. Thomas claim, and developed an additional flow of about 2000 gal. per min. It is estimated that the flow from the portal is now 12,000 gal. per minute.

In addition to the $900,000 order of J. J. Hill and the $500,000 order of the Denver & Rio Grande R.R. for steel, at the works of the Colorado Fuel & Iron Co. at Pueblo, it is now stated that the Santa Fé R.R. will spend $2,000,000 in new shops, a roundhouse and other improvements at Pueblo, and that some of this money will be spent in double-tracking the road between Denver and Pueblo. It is believed here that the revival in the steel industry will renew activities in the Boulder tungsten mines at Nederland.

Snowslides continue to run in the San Juan mining region and on Mar. 14 four men were killed at the Black Bear mine in Ingram basin, by a slide which carried away the mine buildings, boarding house and commissary.

One of the most stubbornly contested fights that was ever waged in this state, for the control of a rich and dividend-paying mine, was brought to a close recently when Allen L. Burris was reëlected president and general manager of the El Paso Consolidated Gold Mining Co., by 1,367,000 votes as against 1,001,000 for the Bernard faction; the shares voted represented all but 82,000 of the issued stock of the company. The report for the year ended Dec. 31, 1911, shows a cash balance on hand of $105,619, and dividends paid for that year, $61,250. The shareholders are to be congratulated on the outcome. This company has contributed about $80,000 to the construction of the deep drainage tunnel.

Butte

Mar. 13—The effect of the policy of increasing the output of copper from the mines of the Anaconda company is demonstrated by the February figures, which show an increase for that month of over 1,000,000 lb., compared with January, and about 3,000,000 lb., compared with December. The output of the Washoe smeltery, and the works at Great Falls, amounted to 27,450,000 lb. of copper for February, compared with 26,350,000 lb. in January, and 24,450,000 lb. in December. The total output of the Butte district during February was 28,950,000 lb., of which the East Butte company produced about 1,200,000 lb., and there was a miscellaneous production of 300,000 lb., not included in the Anaconda or Great Falls figures. It is probable that there will be a further increase in production for March, as February was a short month.

Salt Lake City

Mar. 14—The furnaces smelting ore in the vicinity of Salt Lake, Mar. 15, were as follows: The American Smelting & Refining Co. was running four furnaces at Murray, on lead ore, exclusive of the furnace on matte concentration. This company has accumulated and stockpiled a large tonnage of lead ores, about 45,000 tons. A large portion of this consists of sulphides. The United States Smelting Co. was running five furnaces and treating its usual tonnage. The wet concentrator was being operated, and the Huff electro-static plant was treating about 50 tons per day of zinc middlings. The Garfield copper smeltery, of the A. S. & R. Co., was running two blast furnaces and four or five reverberatories. The tonnage treated varies between 2000 and 2300 tons of ore per day. The reverberatory furnaces, which have been equipped to burn California crude oil, are understood to be giving satisfactory results. It is reported that negotiations are pending between this company and the Salt Air Beach Co. for the purchase of a tract of land along the shore of Great Salt Lake, near Garfield. The International Smelting Co. has three reverberatory furnaces in blast, at Tooele, treating about 600 tons of copper ore per day. The second lead furnace is practically ready to be warmed up. A good-sized tonnage of lead ore has been accumulated. In addition to lead ore received from Park City, the Cœur d'Alene, Bingham, etc., from five to eight cars of tailings per day are being received from the Prince company, near Pioche.

It has been announced that the International company has acquired land in East Chicago, Ind., on which a lead refinery will be built soon.

A new business of direct interest to the mining industry is promised for this section soon. The Utah Powder Co., composed of Utah and Pennsylvania men, has secured a tract of 80 acres, suitable for a powder plant, near Centerville, about 12 miles from Salt Lake City, and expects to begin the manufacture of explosives during the coming spring or summer. Arrangements for raw materials have already been mad, and machinery will be purchased soon. It is believed that the mining industry in this state and neighboring districts, of which Salt Lake City is a center and source of supplies, will furnish a market for the product.

Orders signed by President Taft, Mar. 4, for the withdrawal of nearly 2,000,000 acres from entry in this state, have been received by the local Land Office. This is the largest temporary withdrawal in the history of the state. The first order calls for the withdrawal of 1,354,240 acres in Emery and Wayne Counties, supposed to contain petroleum. The second order withdraws 620,160 acres supposed to contain coal, in Utah, Carbon, Emery, Sevier and Sanpete Counties. Under the head of temporary withdrawals, all the lands will be closed to entry until the U. S. Geological Survey can make investigation and reclassification. The coal lands in question extend from Colton on the north, along the east side of the Wasatch Range to a point below Richfield. The supposed petroleum lands are southeast and southwest of the San Rafael swell, near the head waters of the Fremont River and tributary streams. Small tracts of land, near Echo, in Summit County, and near Parowan, in Iron County, withdrawn as coal lands, have been restored to entry.

Deadwood, S. D.

Mar. 15—The winter of 1911-12 will go down in history as one of the most severe ever experienced in the Black Hills. The first snow fell about Oct. 15, and up to the present between 8½ and 9 ft. have fallen. At times the temperature has been unusually low, and there has been but little thawing weather since early in December. The entire snowfall of the winter still lies upon the northerly exposed hillsides, something unusual in this section, which is not at a great elevation. A few days ago one of the railroads operating in the Bald Mountain district had occasion to open some track which had not been used during the winter, and in some of the cuts the snow was found to be 17 ft. deep on the track. This heavy snowfall, which will, no doubt, be augmented by the customary April storms, practically assures a splendid water supply for the coming summer.

The destruction of the Mogul mill was a serious blow to the mining industry, throwing nearly 100 men out of employment, including the mill employees and railroad men engaged in hauling to the plant. However, the mill will soon be rebuilt, and meanwhile the mines are being operated at part capacity. The directors of the Mogul company for some time have had under consideration the construction of a plant convenient to one of the properties containing a large tonnage of low-grade ore. This material is too low in grade to stand shipment, and it is believed that such a plant would be able to handle the ore at a profit. In this event the Pluma plant will continue to operate.

Negaunee, Mich.

Mar. 16—The U. S. Circuit Court of Appeals, sitting at Cincinnati, Ohio, has handed down a decree requiring George J. Maas, of Negaunee, to convey to Margaretha Lonstorf, of Milwaukee, Wis., a one-sixth interest in the fee of the Negaunee mine, of which George Maas held a one-half interest. The Negaunee mine is operated by the Cleveland-Cliffs Iron Co., and has an orebody estimated at 14,000,000 tons. The case had been appealed from the decision of Judge Knappen of the U. S. Court in Marquette, whose decision was similar to the one given at Cincinnati. The trouble grew out of alleged misrepresentations made by George Maas to Mrs. Lonstorf, who is his aunt. In 1898 Mrs. Lonstorf and her sister, Mrs. Maas, each owned an undivided one-third interest in the Negaunee mine. George Maas, who has conducted considerable exploration work for iron ore, diamond-drilled the property and added to the holdings by securing options on other tracts lying to the west and northwest. Later, when he turned the properties over to the Cleveland-Cliffs Iron Co., it is alleged that he withheld important facts from Mrs. Lonstorf when he paid her $100,000 for her share of the holdings.

Phoenix, Ariz.

Mar. 10—There is apparently a noteworthy awakening of interest in the mining districts of the southwest, due partly to the exclusion of operators and investors from the Mexican fields but chiefly to the rise in the price of copper and to the present availability of the zinkiferous ores. An unusually large number of engineers have been making investigations in the older camps of Arizona and New Mexico and several important negotiations are under way as a result.

Some of the long quiescent districts have been reinvestigated this winter and it is expected that in some cases operations will be renewed. Many of the negotiations pending are for smaller properties, indicating that the general public is again disposed to take a hand in the mining game. At present, more than formerly, the negotiations and investigations are being conducted under the direction and advice of mining engineers of good standing. It is expected that the present year will witness an increase in operations generally throughout the southwest.

Hailey, Idaho

Mar. 14—On the whole, mining conditions in the Wood River district remain quiet. Two determined efforts, backed by capital and competent geological advice, are being made to reopen former producers of silver-lead ore. In one of these operations it has been found that the galena zone, at depth, has been succeeded by contact metamorphic rocks, resulting from the alteration of slates and limestones, through the influence of dikes of acid igneous rock. The interesting part is that the silver and lead have disappeared and that the metamorphic rock carries some free gold, but whether the latter will be found in bodies of economic importance remains to be seen.

Some development like this for the region is possible. There is a general family resemblance among the different ore occurrences, and this has been shown particularly in the manner of the "petering out" of the original galena bonanzas.

Toronto

Mar. 15—The Amalgamated Asbestos Corporation will hold its annual meeting at 11 a.m. on Wednesday, Mar. 20, and at 11:30 a.m. on the same day, a special general meeting of the shareholders will be held to consider a notice of entry made by the Royal Trust Co., trustee for the bondholders, demanding the immediate surrender of the property. A scheme for reorganization has been proposed which will make a drastic cut in the present holdings of the bondholders and shareholders, by which it is hoped to place the company on a more substantial footing.

Hon. W. T. White, Canadian Minister of Finance, delivered the annual budget speech on Mar. 13, in the course of which he announced that there would be no tariff changes in view of the policy of establishing a permanent tariff commission to which all tariff questions would be referred for investigation. He said that while many changes had been asked for, there was no case of such urgency that it could not wait until the commission had pronounced upon it. Further, he stated that he had no proposition to bring forward as regards the renewal of the iron and steel bounties. Earlier in the session it was the general expectation that the strong agitation on the part of the iron and steel interests for the reimposition of the bounties as a temporary measure of relief, would be successful, but the proposal was vigorously opposed by the Western representatives, whose constituents are largely free traders, and was also objected to by a section of the protectionists, who are disposed to prefer an increase in the tariff to the bounty system.

A bill aimed at the coal companies who have brought miners into Nova Scotia to take the places of strikers has been introduced into the Nova Scotia legislature, in the form of an amendment to the Employers Liability Act. It provides that it shall be illegal for any employer to bring any workman into the province during a strike, or lockout, or within 20 days previous to a strike, or lockout, without having given notice to such workman of the strike or lockout.

Porcupine

Mar. 15—A London dispatch states that the first report of the Northern Ontario Exploration Co., of which Bewick, Moreing & Co. are general managers, has been issued. Of the 100,000 issued shares of this company, 40,000 are held in Canada. The operations in Porcupine and elsewhere, since incorporation in January, 1911, yielded £81,481 profit; £40,000 have been written off from the cost price of the shares, since only a limited amount of development work has so far been accomplished. Cash in the banks and cash receivable amounts to £101,000, while other assets were acquired at a cost of £103,000. The whole balance of profit is being carried forward to the current year, for the development of new enterprises in Alaska and other places. From these figures it is evident that the company has disposed of the balance of its holdings of Hollinger stock, since the cash on hand has been increased from £85,000 to £101,000. Not long ago the company had 6000 out of the original 50,000 shares of Hollinger, in the treasury. The company's Porcupine properties have not, so far, developed anything of importance.

The Mining News

The Current History of Mining

Alaska

Reports from Ruby City indicate that the camp will be a busy one during the coming season. A number of new strikes have been made.

Imhoff & Salisbury—A stamp mill has been ordered for this property, and will be transported soon to the proposed mill site in the Moose pass.

Williams-Gentzler—George Leekley, Valdez, who holds an option on this property at the head of Mineral Creek, is contemplating the erection of a stamp mill.

Newsboy—This mine is under lease to McGillvray & Fisher, who will install a small mill and a hoist.

Reliance—A 3-stamp mill is being installed on this property, at the head of Dome Creek. W. L. Spalding is in charge.

McKinley Lake—On this property, in the McKinley Lake district, operations have continued throughout the winter, owing to the mild weather. A tunnel is now in 125 ft., and some ore recently encountered assays $14 per ton.

Herschberger-Buell—Ore from this property is averaging $50 per ton. The mine is under lease to Doctor Overgaurd, of Fairbanks.

Chicagoff—New machinery has recently been installed on this property near Sitka.

Cliff—The machinery at this mine is again in operation and a recent run of three stamps showed a return of $800 in gold. The property is near Valdez; B. F. Millard is president.

Arizona

Gila County

Old Dominion—Lining of the Kingdon shaft with concrete is progressing, and the second section of 145 ft. has just been completed, making a total distance of 305 ft. from the collar that has been finished. About 20 men are employed, working two shifts, and the work advances at the rate of about 12 ft. vertically per day.

Needles—This group of 27 claims, and 13 adjoining claims, have been bonded to W. F. Kennedy, of New York. They are situated four miles west of Miami and are joined on the east by the Barney group, now being explored, and the Montezuma group, which is being churn-drilled by the Southwestern Miami company. They are joined on the south by the Schultze group, under option to the South Live Oak Development company.

Gibson—The Gibson Copper Co. is working the mine, 16 miles west of Globe, with 12 men under T. Henderson. It is preparing to make its second shipment of chalcopyrite ore, since the mine reverted from the Summit Copper Co. The ore comes from the south 400 level on the Pasquale vein and will probably assay over 20% copper. The south drift is being extended on this level and an 8-in. streak of ore is reported in the face. Drifting has been started on the 500 level, which is reached by a raise from the crosscut on the 600 level. The ore is hauled by teams eight miles to Miami where it is loaded on cars and shipped to the Old Dominion smeltery at Globe.

Globe-Ray—This development company has started work on the property formerly owned by Robert Goodwin, 22 miles southwest of Globe. Sultan & Wayne, and John C. Gibson are interested in the company. The mine was at one time under lease to Thomas Farish and associates, who shipped 400 tons of copper ore to the Old Dominion smeltery, that netted about $10 per ton, but it was closed down in 1907. The claims are traversed by a fissure vein in the Pinal schist, opened by an inclined shaft 280 ft. deep, from which 600 ft. of drifting have been done at four levels. Four men are repairing and unwatering the shaft, preparatory to resuming work in the mine. The equipment consists of an 8x10 steam hoist, a blower, a Cameron sinking pump and the necessary buildings.

Southwestern Miami—Hole No. 2 is 900 ft. deep and is in silicified schist. The 6¼-in. tools and casing are now being used. Hole No. 3 is in schist and is 170 ft. deep. The two new churn-drills will be shipped soon by the Star Drilling Machine Co. All drilling tools will be furnished by the Union Tool Co., of Los Angeles. A car of casing and all necessary cables, etc., has been ordered, also a steel derrick 59 ft. high that can be erected over a hole while the machine is running so that if it becomes necessary to drill an unusually deep hole, it can be accomplished without difficulty or delay. This derrick will be about 20 ft. higher than the one on the drilling machine. Plans have been drawn for the erection of a new warehouse, an addition to the office building, a building for storing samples, and six tent-houses for the workmen.

Barney—Hole No. 1 is 1250 ft. deep and still in the red, hematite-stained schist formation that it encountered at 1100 ft. Water, which was encountered in the dacite formation at a depth of 960 ft., is still flowing out over the top of the casing and is being used by the drilling machines.

Superior & Boston—The east drift on the 12th level on the Great Eastern vein has been advanced 30 ft. from the crosscut and is breasted in chalcopyrite ore for its full width. The width of the ore is unknown as the hanging wall is not exposed. The ore is reported to assay 3½% copper and about 40% iron, the chalcopyrite being imbedded in a gangue consisting mostly of hematite. Discovery of ore in this part of the vein is considered important. The west drift is in 160 ft. and is breasted in shattered, iron-stained diabase. The crosscut, which has been continued beyond the Great Eastern vein to strike the Old Dominion vein, is in 350 ft. The crosscut being driven southeastward from the shaft is in 85 feet.

Five Points—This mine, 15 miles west of Globe, is being developed by seven men under A. T. Hammons, manager for the Manitou Copper Co. The Cracker Jim shaft is being sunk and is now 130 ft. deep. It is proposed to crosscut at 200 ft. The ground is traversed by two fissure veins in the granite porphyry, from which some high-grade copper ore has been shipped in the past.

Pinal County

J. Jay Sullivan, of Phoenix, is negotiating with Pittsburg men for the sale of his vanadinite mine near Florence. The property has been extensively developed.

Yuma County

Bonanza—Reports state that this and the Golden Eagle property, nine miles southeast of Salome, have passed into the hands of H. W. Stevens, W. J. Martin and associates. The mines are in the Harquahala Mountains, and are extensively equipped, including a 40-stamp mill.

Arkansas

Red Cloud—The contract for the new mill for this mine in the Yellville district has been let to F. W. Watts, of Joplin, Missouri.

California

Amador County

Plymouth Consolidated—The Pacific shaft is being unwatered. After pumping to 140 ft., two 550-gal. water skips were put in operation.

South Jackson Mining Co.—This incorporation succeeds the South Jackson Gold Mining Co., and has paid its indebtedness. The sinking of the shaft and the installation of an electric hoist will proceed. V. S. Garbarino will have charge of the surface improvements. The directors are: Jeffry Schweitzer, San Francisco; J. E. Davis, Sutter Creek; F. W. Ruhser, Adam G. Huberty and C. P. Vicini, Jackson.

Calaveras County

Chapman—Work on the new gallows frame has begun, and it is reported that a new mill building will be built. A bank of good gravel has been opened. I. N. Chapman, Alameda, is principal owner. D. Cavagnaro is superintendent.

Kern County

A large deposit of magnesite is reported to have been found recently, about 10 miles east of Mohave, within half a mile of the Sante Fé railway, by J. A. Durnell, B. M. Dennison and others, most of whom are residents of Tehachapi.

Merced County

Yosemite Dredging & Mining Co.—L. K. Vaughan has sued this company for $7800, alleged to be due as salary under an agreement by which Vaughan was to receive 3% of the stock and a salary of $200 per month, for locating the company on the dredging land. He received the stock.

Nevada County

It is reported that the Great Western Power Co. contemplates extending its line to Nevada City and Grass Valley, thus competing with the Pacific Gas & Electric Co. in supplying power to the mines in these and other districts in Nevada County.

Plumas County

Bear—The mine has been taken over by C. Gatewood, of Genessee, and George Howard, of Sacramento, who will develop the property and install a plant for treating the ore, if the results justify. H. G. Goodhue is owner.

Shasta County

The town of Kennett, where is situated the Mammoth copper smeltery, was partially destroyed by fire, believed to be incendiary, on Mar. 10. Only the business section on the east side of the railroad was burned. The loss totaled $82,000, on which there was $33,000 insurance. The smeltery and other property belonging to the Mammoth company were not damaged.

Mount Shasta Power Corporation—This is a new incorporation, organized by J. W. Lilienthal, attorney, of San Francisco, for Eastern men. Electric power will be generated from the Pit River. The articles of incorporation are filed at San Francisco. The capital stock is $10,000,000.

Sierra County

Black Barn—Alfred Burgan has uncovered gravel carrying much coarse gold, on this claim near Downieville.

Croesus—The richest ore struck in many years has just been encountered in a new shaft which is being sunk at this old mine near Alleghany.

Rainbow—Modern machinery, is being installed at this Alleghany mine, preparatory to sinking on the original Rainbow shoot.

Kate Hardy—Another rich find has been made on the Mountain House-Goodyear Bar serpentine belt. W. M. Beggs and associates, of San Jose, are the owners.

Brandy City—A plant has recently been installed to treat the black sand from the tailings of the hydraulic mine. C. H. Gowman, of Los Angeles, representing the company operating this separating device, has just made an inspection of the plant.

Siskiyou County

Mono—The office of the company will be removed from San Francisco to Yreka. A modern cyanide mill and classifier will be installed. The present owners have expended about $37,000 in labor and equipment, and have the mine in good shape for production. The North American Mining & Development Co. is the owner and S. J. Silva is general manager.

Trinity County

Globe Mining Co.—This company has secured a favorable decision in the U. S. District Court, at San Francisco, in the contention with the Trinity County Gold Mining Co., regarding the ownership of mining claims.

Tuolumne County

Stamps are dropping at properties in this county as follows: Harvard, 60; Dutch, 20; App, 60; Jumper, 40; Eagle Shawmut, 100; Clio, 10; and 40 at Black Oak.

Harvard—Sinking the main shaft is progressing and the placing of concrete mortar blocks under the stamps is under way. The installation of a cyanide mill is contemplated. H. W. Gould, Jamestown, is superintendent.

Mexican Diggings—V. H. Kleppinger, of Allentown, Penn., has taken an option on 160 acres of the Prereira ranch, including this old mine, near Jamestown, and expects to interest Eastern men in its development.

Colorado

Clear Creek and Gilpin Counties

McClellan—The creditors of this tunnel company are planning to sell the property to protect claims amounting to about $80,000. The tunnel is driven 7100 ft. and in another 1100 ft. will cut the Freeland vein system. Nearly $500,000 have been expended on the work. George B. McClellan is manager.

Newhouse—Two hundred tons of ore per week are being shipped to the Jackson concentration mill from the Dyke vein, cut by this tunnel. Five tons are concentrated into one, making the product worth $35 per ton. The leading mines are now giving leases on a 10% royalty, and this is stimulating mining.

Cripple Creek District

Ajax—This mine is now one of the leading producers of the Battle Mountain section, and the February output is stated by Supt. E. A. Colburn to have been 48 cars of $28 ore. The mill is said to be handling 3000 tons per month.

Mary McKinney—In February, seven cars of $25 ore were shipped on company account and 18 cars by leasers. From the new level the drift on the vein is in 60 ft., and shows 3 ft. of ore, stated to run $60 per ton.

Elkton—The main shaft is being sunk another lift of 100 ft., giving 170 ft. in height of stoping ground on the main vein.

Gold King—In a winze from the sixth level, lessees George Roerig & Co. are reported to have made a good strike of sylvanite ore.

Granite—The 1000-ft. level, under water for three years, has been drained by the deep tunnel, and Supt. Daniel McCarthy has cut a vein in the Dillon claim, in which a 4-in. streak is said to run as high as 17 oz. of gold per ton, the rest of the vein giving, by assay tests, over 1 oz. of gold per ton.

American Eagles—Five cars of smelting ore, averaging $60 per ton in gold, have been shipped from this mine of the Stratton estate. It is said to be the richest shipment in five years.

Specimen—This Stratton's estate property, under lease to Argall & Johnson, is producing four cars per month of screenings, containing 1½ to 2 oz. of gold per ton.

Pharmacist—The February ouptut from a block on the first level of this mine was five cars of 1-oz. gold ore. The vein is 3 ft. wide. Matha & Co. are lessees. Thomas Ward is manager.

Lake County—Leadville

Siwatch—The breast of the tunnel is 4400 ft. from the portal, and crosscuts are being driven east and west, the latter being 700 ft. long.

Pioneer—This mine, at Empire, produced 110 tons of ore last month that yielded 30 oz. gold bullion, and 50 tons of concentrates worth $40 per ton. In February, 40 tons of ore, running 4½ oz. gold per ton, were shipped from the upper workings of the Empire tunnel, and 20 tons of 3½-oz. gold ore were shipped from the Americus.

Fairplay—In this mine, in Stray Horse Gulch, the new strike has now been driven on for 40 ft., and the ore is 4 ft. thick; two cars shipped are said to average 1 oz. of gold per ton, with some silver and lead.

Ibex—The lessees are shipping steadily and are doing well. From the fourth level, No. 2 shaft, James Barnes has sent out a car of ore that returned 8 oz. of gold per ton. From No. 1 shaft, the Jacketts lease is shippin a car per day of zinc-carbonate ore.

SUMMIT COUNTY

Wilson—The King Solomon Mining, Tunnel & Transportation Co. recently secured this shaft and mill, situated in the flat between the towns of Robinson and Kokomo, and have resumed operations with 50 men.

TELLURIDE

Many mines throughout the state are going to erect their own mills this year. The Wild Boy mine near the Alta mill on Gold King Creek is to have a small mill in the spring and W. M. Herrington, the manager, will install a tramway to connect the mine with the mill. George Pickett, manager of the Suffolk mill, will install a cyanide plant in the spring for the Suffolk and Favorite ores; the San Bernardino, which has 4 ft. of mill ore which will not pay to ship, will have to install a mill for treatment at the mines.

Idaho

COEUR D'ALENE DISTRICT

Gettysburg—Ore has been encountered at this property in the old No. 3 tunnel. The strike shows 7 ft. of good milling ore, containing several streaks of high-grade, shipping ore. The property is in the Mullan district, between the Morning and Gold Hunter mines. Work was resumed recently, the burning of the surface structures during the forest fires in 1910 having stopped all work. The ore has not as yet been encountered in the lower tunnel which is in nearly to the vein.

Alice — The mill is being rapidly overhauled and should be ready to handle ore from the mine in about two weeks. The work of unwatering the mine is progressing rapidly and little trouble is being experienced. The 600 level is now accessible and ore is being hoisted.

Black Horse—The ore at this property continues to improve in the raise being driven. This raise is up 200 ft. above the tunnel level and is entirely in ore, the exact width of which is not known. A drift will be run on the same orebody to determine the length. A shaft will be sunk on another body of ore which has been encountered in the lowest tunnel. The mill cannot handle all the ore now being mined.

Northern Light—The shaft is down 160 ft. Seven men are employed and are making about 2 ft. per day. A crosscut will be started at 180 ft. depth, in the hope of cutting the vein within 50 ft. of the shaft.

Michigan

COPPER

Franklin—During February the mill stamped 9000 tons of rock and received a mineral yield of about 220,000 lb. This company is at present handling about 620 tons of rock per day, but this is to be increased as fast as additional men can be taken on and underground conditions warrant. About 30 drills are in use and will be increased to about 50 when necessary.

Lake—This company is sending the rock from its stockpile to the Trimountain mill; production has not been regularly started but by the time the stockpile has been cleaned up it is probable that things will be in readiness so that production from the underground openings can be maintained.

Osceola—Charles M. Turner has secured a temporary injunction from Judge Weist, of the court at Lansing, restraining the company from holding its annual meeting. Some of the contentions made by Mr. Turner recently were that the management is mining rock from the Kearsarge branches while working the old mines would be more advantageous to the stockholders; also that the proposed changes in the milling of the rock are not warranted and would not be economical in face of the money involved.

Adventure—The crosscut from the 15th level of No. 5 vertical shaft has been extended about 450 ft. from the shaft and is breasted in the horizon of No. 2 lode, from which the rich drill core was extracted; results are being waited with interest.

Seneca—T. L. Chadbourne, Jr., of New York, is soliciting proxies for the annual meeting. The Chadbourne family is reported to own 1121 shares, constituting the largest minority interest, and for that reason are seeking representation on the board of directors.

Victoria—The report for the year ended Dec. 31 shows: Total receipts, $273,008; total expenditures, $210,659; balance of receipts over expenditures, $62,349; surplus previous year, $1694; total surplus, $64,043; copper sold, 1,030,993 lb.; received for copper sold, $126,497; copper on hand, Dec. 31, 272,338 lb. Air-hammer drills were gradually installed during the year, and for the last four months all stoping machines have been air-hammer drills. It is stated that these machines have materially reduced stoping costs.

IRON

The E. J. Longyear company, which is diamond-drilling on land of the Pittsburg & Lake Superior Iron Co., under option to Minneapolis men, has now two drill crews and three drill outfits at work. The drills are situated southeast of the village of Palmer, and the drilling consists in deepening holes that were started several years ago. L. D. Cooper, of the Longyear company, is in charge of the work.

American—At this mine of the M. A. Hanna Co., situated west of Ishpeming, important developments are underway on the lower levels. On the ninth level a drift is being driven west to develop the extensive holdings taken over from George Maas, which were diamond-drilled by him. The shaft is being gradually deepened and will soon be finished to the 13th level; plats are being cut as the shaft is sunk.

Wisconsin Mining Co.—This company has been organized at Iron River, under Utah laws. The company is largely composed of local men, and the officers are as follows: President, James Long; vice-president, A. T. Wooster; secretary, J. B. Weimer; treasurer, Frank Singler; James Pardee and the above officers make up the board of directors. The authorized capital is $100,000, divided into 1,000,000 shares of the par value of 10c. An option has been secured on the MacFarland property, north of Iron River. This 80-acre tract has been explored before, but not thoroughly.

D. M. & M.—Local men in Iron River are exploring these lands in Sec. 33-T. 43-R. 35, and Sec. 4-T. 42-R. 35, situated about two miles west of the Hiawatha mine. Nine diamond-drill holes have been sunk by the McPherson Exploring Co. to depths of from 150 to 200 ft., and ore of fair grade is reported to have been cut; the overburden is shallow, being usually less than 40 feet.

Davidson Ore Co.—At the Gleason shaft of this company, which is a subsidiary of the New York State Steel Co., one mile north of Iron River, a new wooden headframe has been erected. Plans are being made for a new engine and boiler house at the property, to be of brick and steel. Rudolph Ericson is superintendent.

Iron River Ore Co.—This company, which is exploring the Buchholtz property west of Iron River, reports the shaft to be down 367 ft., and that 60 ft. of ore have been cut; a test pit 500 ft. south of the shaft is down 107 ft., with the bottom in ore. A drill is operating on the western end of the property, and the McGreevy Iron Co., which is drilling the

quarter-section lying just west of the Buchholtz, reports that ore has been cut. Capt. J. N. Porter is in charge.

Minnesota

Mesabi Range

St. Paul—This mine at Kewatin, operated by the Corrigan-McKinney company, is commencing repairing operations for the coming season. Drilling will be started by the E. J. Longyear Exploration Co., with three or four drills.

Elizabeth—This company, operating the Elizabeth mine at Chisholm, has been taken over by the Claire Iron Co., which is controlled by the M. A. Hanna Co. The equipment is being overhauled and repaired for active operation this season. The boiler capacity has been doubled, so the property should be in a position to handle all water encountered.

Buffalo—The new 9x12-ft. shaft which is being sunk has been stopped on account of water. The shaft is down about 70 ft. and sinking pumps are being installed, after which the work will be pushed to completion. This shaft will be used for water-discharge lines, steam lines and for carrying the electric power underground, and will not be used as a hoisting shaft either for men or ore. This property is at Hibbing and is operated by the Rogers Brown Ore Company.

Webb—The company has just completed six new houses at the mine; with other indications, this points to a large tonnage for this season. The Shenango Furnace Co. operates this property.

Montana

Butte District

Tuolumne—During 1911 the company produced 30,499 tons of ore containing 4,261,705 lb. of copper, 96,373 oz. of silver and 45 oz. of gold. Only first-class copper ore was mined and the average copper content was 7.15%, and of silver 3.23 oz. The 3-compartment shaft was sunk 177 ft. to the 1800-ft. level; 1362 ft. of crosscutting, 1196 ft. of drifting and 866 ft. of raising were done during the year. A new hoist was installed and a steel hoist-house and cooling tower erected, also a steel head-frame and 600-ton, frame orebins. No shipments of ore from the new orebody on the 1800 level have been made yet as the ventilation is poor; to obtain good air a raise is being put up from the 1800-ft. level to connect with workings of the North Butte company. After this, mining will be commenced there. At a meeting of stockholders, Mar. 11, the following directors were reëlected: Edward Hickey, Jere Clifford, Daniel Shields, R. J. McDonald, J. W. Pratt, N. J. Bielenburg and Thomas E. Murray, of St. Paul. Mr. Hickey was reëlected president; R. J. McDonald, treasurer; Mr. Bielenburg, vice-president; J. J. Harrington, secretary.

East Butte—The improvements in the surface plant are being rapidly carried toward completion, and a few months more should see everything in working order with increased efficiency.

La France—The plan of reorganization provides for the formation of a new company, the Lexington Mines Co., which will purchase at a foreclosure sale the first-mortgage bonds of the present company. Present indebtedness consists of $2,000,000 first-mortgage bonds and $500,000 overdue coupons. The new company will have a capital of 100,000 shares of common stock, par $10, and no bonded or other indebtedness. Of the new stock, 25,000 shares will go to the reorganization managers in payment of property, 25,000 shares will be sold for cash at par and 50,000 shares will be reserved for future sale.

Lincoln County

Kalispell-Lincoln—The company expects to install a stamp mill this summer. A mill test recently made is stated to have returned over $100 per ton in gold. J. J. Hibbard, of Libby, is manager and he has been working a force on development for the last year, except for a few weeks in the winter. The mine is about 35 miles south of Libby.

Montana Smelting Co.—William Jennison, receiver for this company, operating the Snowshoe mine, has practically discontinued operations at the property. The owners expect to straighten the company's financial affairs soon. They recently made a payment of $3000 on an extension of the property contracted for last fall. The shaft is the deepest in the district, having been sunk to 500 ft. during the last year.

Hazel T.—The company has men at work in the lower tunnel, which it is expected will soon crosscut the vein at a depth of 300 ft. The property consists of the Shaughnessy Hill group of claims. In the upper workings some silver-lead shipping ore is shown; in places this is 25 ft. wide. The property is eight miles southwest of Libby, and John H. Town, of Libby, is manager.

Victor-Empire—Work is progressing on a new and lower tunnel on this silver-lead property, 12 miles southwest of Libby. Several oreshoots were encountered in the upper tunnel and the showing encouraged the driving of a tunnel lower down the mountain. P. S. Rose, of Libby, is the secretary and is in charge of the work.

Mountain View—W. H. Graham and Paul D. Pratt have taken a bond on this group of claims, in the West Fisher district, 40 miles from Libby. The claims have produced some rich specimens, but have not been extensively developed. Pratt and Graham are visiting the property now and will decide upon operations, but they expect to begin shipping ore during the summer. Some machinery will probably be installed.

Nevada

Comstock Lode

Mexican—According to Superintendent Symmes, the mill, for five weeks ended Mar. 2, handled 1971 tons of ore, the gross assay value, from head samples, being $41,766. During February, it is estimated that ore worth $34,497 was treated, and that the net bullion yield for that period will be $26,465. Three bars of bullion, estimated to contain $8000, were shipped to the smeltery last week.

Ophir—On Mar. 12, the company shipped 34 tons of concentrates to the Selby Smelting Co., this having been recovered from approximately 1000 tons of ore treated at the Kinkead mill, being a part of Run 38. The shipment had an assay value of $25,000, or over $700 per ton. It is expected that the entire run, with the bullion cleanup, will net between $50,000 and $60,000. The ore recovery from the mine last week was 250 tons averaging $30.85 per ton.

Con. Virginia—A 3-compartment raise in the ore streak has been started on the 2400-ft. level, and is three sets above the sill floor. Ore of milling grade continues on the west wall of the formation, and is about 3 ft. wide, the vein being 8 ft. wide at that point. The balance of the material is low-grade quartz.

C. & C.—The first shipment of new pumps, consisting of three horizontals, a sinking pump and a motor, were received last week from the Byron Jackson Iron Works, and their installation will be started at once. The first station to be equipped will be the new 2310, and the other pumps when they arrive will be placed on the 2500, and at the head of the old joint Ophir-Mexican winze. The latter pump will aid in pumping out the north-end mines from the 2500- to the 2900-ft. levels.

Ward—Another increased flow of hot water has been secured in the north drift on the 2450-ft. level of the shaft, and is being pumped to the Sutro tunnel drain.

Crown Point—A cleanup was made last week at the Yellow Jacket mill, to which plant ore shipments have been made continuously since Jan. 25. A 25-ton car of concentrate was shipped to the smeltery.

Esmeralda County

Atlanta—It is rumored that a new company, to be headed by George Wingfield, is being formed to take over this property, and to conduct development work at depth, this work to be commenced from the deepest available level of either the Goldfield Consolidated or Goldfield Merger Mines Company.

NYE COUNTY

Tonopah ore shipments for the week ended Mar. 7 were: Tonopah Mining, 3550 tons; Tonopah-Belmont, 2250; Montana-Tonopah, 962; Tonopah Extension, 1015; West End, 775; McNamara, 520; total, 9072 tons, and $226,800 estimated value.

Montana-Tonopah—The oreshoot on the 350-ft. intermediate level is 200 ft. long and 15 ft. wide, and averages over $100 per ton. It is still lengthening on its eastern and western course and it continues upward for 125 ft. The new vein on the 615-ft. level is 3 ft. wide and is of high grade. The company's monthly profits for the first three months of this year will amount to double the average monthly profits of last year.

Mizpah Extension—The company is sinking a winze from the 1000-ft. level in a quartz vein 12 ft. wide, showing 16 in. of high-grade ore. The north crosscut on the 1150-ft. level is in the footwall side of the eastern extension of the Belmont company's Lillie Belle vein.

Tonopah Mining—The company's net profits for February amounted to $147,933 from 14,326 tons of ore crushed, of an average grade of $19.45 per ton.

Tonopah-Belmont—The main shaft is being retimbered from surface to the 1000-ft. level and production is being maintained through the Desert Queen shaft. In the east drift on the 12th level the Belmont vein shows a full face of smelting ore and the winze from this level, over 100 ft. deep, is all in ore of smelting grade.

Keane Wonder—The mine and mill are closed temporarily on account of the breaking of the cable of the bucket tramway that delivers the ore a distance of one mile to the mill. The cable had been in constant use for about three years. The new one will be about 11,000 ft. long, weigh 26,000 lb. and will cost $7280, which, with rail, freight and wagon haul from Rhyolite will make the cost $8410. Including the cost of construction and loss through delay, the total cost of installing the new cable will be about $10,000.

New Mexico

GRANT COUNTY

Apache Box—A. E. Shirley, of Shelton, Ariz., has filed a suit at Silver City, involving the ownership of these mines in the western part of the county. The mines are said to contain the largest known deposit of gold-bearing ore in New Mexico. Several million tons of $3 ore are claimed for the property.

SOCORRO COUNTY

Much local interest has been aroused in the proposed railroad from Silver City to the Mogollons and on north to the coal fields. Should the project be consummated, the severest handicap of this district would be overcome as the costly 90-mile wagon haul has been detrimental to the economical operation of many of the properties.

Ernestine—The last bullion clean-up for February resulted in 6785 oz.; concentrates for the same period, 7000 lb. The total output for the month was 24,825 oz. of gold and silver bullion and 15 tons of concentrates. The Allis-Chalmers batteries recently placed in commission are operating satisfactorily.

Deadwood—A new crankshaft for the oil engine has been shipped and should arrive in Silver City soon. Everything at the plant will be in readiness to receive it on arrival and it is likely that by Mar. 25 the mill will be in full operation.

Oregon

LANE COUNTY

West Coast—A $6000 brick of gold was brought down from these mines recently by G. T. Hogg, manager, and was forwarded to the assay office in Seattle. The company is one of the largest operators in the district, but at present is operating only the Champion mine, from which this gold was obtained. The mill on the property has been running intermittently all winter. When the snow goes and the Musick mine can be operated, it is expected that the output of the mill will be greatly increased. The ore from the Musick is sent to the Champion mill by an electric tramway over a mile long.

Combination—The Clark brothers, owners of this property, are doing some development work with the view of putting in a new type of mill in the spring. The ore is silver-gold.

South Dakota

BLACK HILLS DISTRICT

Mogul—Fire recently damaged this company's cyanide plant at Pluma to the amount of $75,000. The loss is fully covered by insurance. The sand-leaching department, precipitation room and Moore-filter plant were saved, practically unharmed. The rolls and chilean mills are in fair shape. The crushers, settlers, Dorr thickeners, ore bins, elevators and over half of the building, which was constructed of pine, are a total loss. It is the company's intention to rebuild the plant as soon as settlement is made with the insurance companies. Insurance to the amount of $155,000 was carried. At present 100 tons per day are being shipped to the Lundberg, Dorr & Wilson cyanide plant, at Terry, and other arrangements for treating additional ore are pending.

Homestake—Water was turned into the hydro-electric plant on Spearfish Creek, a few days ago, and on Mar. 15 the full available head was turned into the ditch and through the tunnel, the generating station, pipe lines, etc., being given a good test.

Black Hills Smelting Co.—Paul Danckwardt has resigned as superintendent of this company's property and plant at Galena. Pending the selection of a new superintendent the work of completing the plant is proceeding, and it should be ready to blow in soon, although the directors may decide to postpone starting until later in the spring.

Texas

Explorations for copper near Quanah, Hardeman County, are being made and good results are reported. The ore is in a clay formation which is said to run from 3 to 5% copper. The treatment is a difficult problem.

Utah

JUAB COUNTY

Tintic shipments for the week ended Mar. 8 totaled 205 cars. During February, 134 cars, or approximately 6700 tons, in excess of shipments during February, 1911, were shipped out of the camp.

Chief Consolidated—Shipments are being made from the orebody opened in December. During the last week, 16 cars of good ore were shipped, compared to 14 cars for the week preceding.

Carisa—A cave-in occurred recently from the 200- to the 400-ft. levels in the shaft. Retimbering must be done for this distance.

Dragon Consolidated—The orebody opened on the 600-ft. level is reported to be 12 ft. wide, the ore carrying lead, silver and copper. Only one wall of this body has been found. The ore is thought to be a continuation of the Iron Blossom orebody, and the Dragon has about 4000 ft. of undeveloped limestone country.

Eagle & Blue Bell—A car of lead carbonate ore running 40% lead has been shipped from the 700-ft. level. Shipments during February amounted to over 1000 tons, largely from between the 1200- and 1300-ft. levels. The shaft is below the 1200 level, and drifting will be done to tap the ore below the 1300 level.

Mammoth—During February, 48 cars of ore were shipped, which brought about $850 per car.

May Day—Raising has been done from the 700, and at 60 ft. above the level a new body of silver-lead ore has been opened. So far this has been of milling grade.

Swansea Consolidated—This company expects to ship from 25 to 50 tons of ore per day from its new discovery, the ore carrying iron and silver. This ore will bring about $8 per ton.

Yankee Consolidated—The company finds that it has more dump ore than was

at first estimated and there is a sufficient tonnage for two months.

SUMMIT COUNTY

Park City shipments for the week ended Mar. 8 amounted to 4,457,980 pounds.

Ontario—The Crowther Leasing Co., operating on this property, proposes to remodel the old Ontario mill soon and to treat the stope fillings and other low-grade ores from the various levels.

Little Bell—Development is being done in new ground between the 600- and 700-ft. levels. Drifting is being done to the south and east of the section that has produced much high-grade ore.

Daly West—During 1911 the mill was run only one shift per day, because of limited hoisting capacity. The ore mined during the last year came largely from the ground between the 1700- and 1900-ft. levels. During the present year, the 900, 1200 and 1550 levels will be further developed. Development included 8573 ft. of drifts, raises and winzes. In order to avoid damage suits with farmers, the Daly West, Daly-Judge and the Silver King Coalition have bought 700 acres of land for impounding the tailings from the mills of the three companies. Ore sales during the year amounted to 22,918 tons of concentrates, 6237 tons of zinc concentrates, and 7083 tons of crude ore, bringing a total of $821,688.

Washington

Oriole—A contract has been let for sinking another shaft at this mine, at Metaline Falls. The ore is silver-lead, and is of good grade. F. M. Davis is manager.

United Copper—The 75-ton stamp mill at this mine is producing $20,000 per month. Conrad Wolfe, Spokane, is president.

San Poil—Work on the large reduction plant for this mine in Ferry County is progressing, and it is hoped to have it in operation early in the spring. The plant will have a capacity of 125 tons per day.

Canada

BRITISH COLUMBIA

Shipments and receipts in tons in the Boundary district for the week ended Mar. 7 were as follows:

Mine	Week	Year to Date
Granby	23,479	217,891
Mother Lode	8,740	77,045
Rawhide	5,574	17,918
Jack Pot	327	3,547
Athelstan	....	340
Emma	....	4,465
Others	476	2,413
Totals	38,596	323,619
Smelteries		
Granby	24,090	263,560
B C. Copper Co	14,040	106,039
Totals	38,130	369,599

Granby—Toronto dispatches state that operations at the Hidden Creek property continue satisfactory, and that from 10,000,000 to 12,000,000 tons of ore can safely be counted on; further, that the intention is to build a 2000-ton smeltery at Goose Bay.

ONTARIO

Brandon Oil Syndicate—The well at Milton was shot on Mar. 12, and a large quantity of oil thrown 100 ft. into the air. The hole has been capped and the pressure of gas is estimated at 150 to 200 lb. Pumping will begin in a few days, and another well will be drilled about 1200 ft. away. A large number of leases have been secured by operators on lands in the neighborhood.

ONTARIO—COBALT

Cobalt shipments for the week ended Mar. 15 were: McKinley-Darragh, 276,052 lb.; La Rose, 143,119; Temiskaming, 86,450; Townsite, 84,000; O'Brien, 77,568; Buffalo, 59,567; Kerr Lake, 41,543; total, 768,299 lb. Bullion shipments were: Nipissing, 125,746 oz.; Crown Reserve, 15,000; total, 140,746 ounces.

Dr. Reddick—This Larder Lake company has assigned to D. Smiley Sawyer, of Ottawa, being unable to meet current liabilities. The liabilities are estimated at $1200, and the movable assets at $50,000.

Right-of-Way—This company has taken an option for five months on properties in the Silver Mountain district, near Port Arthur. Manager Rex Taylor will soon be placed in charge of development work there.

Nova Scotia—The mill has been shut down, as after six months' trial it has been discovered that the pan-amalgamation of low-grade ores and the cyanidation of the tailings is not profitable. For ores in the diabase the process gave good results, but when material from the Keewatin and conglomerate had to be treated, it was found impossible to secure a sufficiently high extraction. A meeting of the directors will soon be held to determine whether the mill shall be transformed to admit of concentration, or whether the contracts for ore shall be abandoned.

ONTARIO—PORCUPINE

The South Porcupine Board of Trade has issued invitations requesting attendance and participation in a celebration and banquet, to be given under its auspices on Mar. 30, the occasion being the official opening of the stamp mill of the Dome Mines Company.

McIntyre—The mill is running steadily. Three shafts are supplying ore from the 200-ft. level. The management proposes to increase the number of stamps to 40 and to add a cyanide plant.

Pearl Lake—The shaft house on this property is nearly completed. It is 30 ft. square and 60 ft. in height, and will be used for hoisting from the bottom of the main working shaft.

Gold Crest—This company will soon sink its shaft to the 100-ft. level. A plant, comprising two 60-hp. boilers, a 5-drill compressor and electric-lighting equipment, has been ordered.

Swastika—At the annual meeting, held recently in Toronto, details for the future financing of the property were explained. Frank Armstrong, of New York, has contracted to take 145,000 shares of the treasury stock, at 45c. per share. The payments for these are to be extended over one year at the rate of $6800 per month, which will cover the working expenses for that period.

Mexico

CHIHUAHUA

Molly Gibson—This company, owner of the Providencia mines, north of Parral, is planning to erect a 100-ton concentrating mill as soon as conditions permit. Dr. W. C. Spencer, of Boston, is president.

JALISCO

An English syndicate is negotiating through W. J. Lohman, of St. Louis, Mo., for a group of mines near Ahualuco, on the Amparo belt.

OAXACA

Cubilete—This company, in the Taviche district, through its consulting engineer, P. A. Babb, has placed an order with the Fraser-Chalmers Co., of London, for the machinery for a 150-ton cyanide plant. The machinery includes 1500-lb. stamps of the South African type; tube mills of especially heavy construction; Paterson tanks for continuous agitation of the slimed ore, and Oliver filter. Zinc dust will be used for precipitation. Tables for concentration of certain of the heavier ores will be provided. Henry Valle is manager of the company. The Taviche district is producing about 100,000 pesos per week in shipping ore. The Cubilete mill should be ready by Oct. 1, and will be the first mill in the district. The San Juan and San Martin properties will begin construction work soon on their cyanide plants.

SONORA

The exportation of graphite from Mexico through the port of Nogales for the three years ended June 30, 1911, was 7397 tons, worth $285,206. The grade of the material was approximately the same each year, the carbon, all graphitic, constituting 86.75%. The graphite is the product of several mines near La Colorado, owned and operated by an American company. The graphite bed is about 10 ft. thick and the mining is done principally by pick and shovel, almost no explosives being necessary.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Mar. 20—The coal trade is irregular and confused, being affected chiefly by strike rumors. The anthracite situation is unchanged from last week, but it is still believed that some settlement will be reached and that there will be no strike—or at least only a short suspension. The public, however, seems to have gone strike crazy, and dealers are securing all sorts of prices for coal. It is a profitable time for them just now.

In the West the interest is centered in the new wage conference, which meets in Cleveland today. It is not very easy to foresee the results of this meeting, but it is quite possible that an agreement will be reached. Meantime the trade is in a nervous and disorganized state.

Nothing new has developed in the German or the English strikes, but the business situation in Great Britain is growing serious. The French strike has been settled.

The Southwestern Interstate Coal Operators' Association reports shipments for the year ended Dec. 31 as follows, in short tons:

	1910	1911	Changes
Missouri.....	1,901,967	2,447,477	I. 545 510
Kansas.....	3,328,569	4,823,929	I. 1,495,360
Arkansas.....	1,437,739	1,495,379	I. 57,640
Oklahoma.....	2,167,014	2,603,762	I. 436,748
Total.....	8,835,289	11,370,547	I. 2,535,258

The shipments reported to the Association include over 90 per cent. of the coal mined in the four states named.

Lake Coal Rates—In Washington, Mar. 19, the Interstate Commerce Commission decided two cases, involving coal rates from the Virginia and Pittsburg districts to Lake ports. In the Pittsburg case the shippers won a victory, the commission ordering a reduction of the rate on bituminous coal from 88 to 78c. a ton from Pittsburg to Lake ports. In the cases respecting rates from Virginia and West Virginia fields to Lake ports, the commission upheld proposed advances from the Thacker districts from 97c. to $1.06½ a ton, and from the Pocahontas districts from $1.12 to $1.21¼ a ton, made by the Norfolk & Western, on the ground that they did not impose an unjust or unreasonable charge for the service rendered. The commission ordered the Baltimore & Ohio, the Chesapeake & Ohio, and Kanawha & Michigan, however, to maintain their present rates from the Fairmont, Kanawha and New River districts, which are, respectively, 96¾c., 97c. and $1.12 a ton. The proposed advances to $1, $1.06½ and $1.21¼ a ton were not to be justified.

Iron Trade Review

New York, Mar. 20—The iron and steel markets continue strong in demand. The spring building requirements promise to be large, both in structural steel and the smaller material. Mills are generally busy, and seem to be rather well satisfied with prospects for the coming two or three months. While there have been no marked advances, there is a general firming up of prices, and new orders are no longer placed at the extreme low points.

The more marked feature of the week has been the development of increased demand for pig iron. This extends to foundry iron as well as to steel-making irons. Bessemer and basic have been in large demand from merchant furnaces, and sales of foundry in Eastern territory have increased. In pig iron also there has been a firming up of prices and a withdrawal of concessions.

A setback to the furnaces has been the sharp advance in coke prices. Part of this is due to strike rumors, and it is doubtful if the advance holds, at least to its full extent.

Coal-strike rumors seem to have little depressing effect on the iron trade, and the general belief is, apparently, that a settlement will be effected without any serious delay.

Baltimore

March 18—Exports for the week included 110 lb. selenium to Rotterdam; 394,780 lb. structural steel, 56,412 lb. nickel-steel plates and 802,860 lb. iron castings to Panama. Imports included 300 tons ferromanganese from Rotterdam; 10,775 tons pyrites from Huelva, Spain; 10,900 tons iron ore from Cuba.

Birmingham

March 18—There is a stronger feeling among pig-iron manufacturers here, and prospects are improving. The general disposition is not to increase production yet, though it may soon be necessary. There is some No. 2 iron in the yards yet, but other grades have been pretty well cleared out, and pipe iron is actually scarce. The basis of $10.50 per ton for No. 2 foundry is being firmly held.

The cast-iron pipe foundries keep very busy, and shipments of pipe are being made all over the country. Foundries and machine shops report some improvement in business. Scrap iron is more active.

The blowing in of the second battery of 70 byproduct coke ovens at the Tennessee company's plant, at Corey, in the western part of the Birmingham district, has already had effect as a reduction in cost of coke is announced. There are two more batteries of ovens nearing completion and the byproducts are in good demand.

Chicago

Mar. 18—The tone of the iron market, in general is firmer, but there is no pronounced increase of sales in any particular line. Pig iron continues, so far as the foundry market is concerned, to sell in small to medium-sized lots, with inquiries frequent as to large tonnage requirements for the last half. Sales are gradually extending into the third quarter and last half, but most of the melters are supplied up to the middle of the year, so that they are cautious about closing for further needs, especially at furnace agents' prices. The demand of the sellers is for a premium over the prices now current, $14 on Northern No. 2 and $10.50 on Southern No. 2, Birmingham, which means $14.85, Chicago.

An increase in the demand for quick-delivery iron is noted in some quarters, which means that the melters are operating on very short headway between purchases and actual use of the iron. There seems in general a distrust of the future among the melters, which is met by a firm stand by furnace agents as to deliveries beyond the first half. For such deliveries the selling agents will not shave prices.

Structural material is finding a better market as the spring advances. Building and bridge material is much in demand and prices are firm at 1.28@1.35c. for material up to 15 in., the tendency being to demand the higher prices on orders that require prompt shipment. Railroad business is still light, though increasing. Steel and iron bars both are somewhat stronger, with soft-steel bars selling at 1.25@1.33c., and iron bars 1.15@1.20c. Billets remain quiet at $26.50 for open-hearth forging billets. Plates are in very good demand, with the price 1.30@1.33c. for ¼-in. tank plates; sheets are selling well at unchanged prices. Wire goods are in demand for spring needs.

Cleveland

March 18—It is understood that ore-handling charges on the Lake Erie docks the coming season will be lower.

Pig Iron—The market is more active and stronger, but there is no quotable change in prices.

Finished Material—New orders are coming in more freely on bars, structural steel and some other lines. Prices on bars and plates are firmer. Specifications on contracts are again coming in more freely.

Philadelphia

March 20—A feeling of general expectancy pervades pig-iron circles in this territory. It grows out of the activity in other markets. The heavy shipments in progress are depleting furnace stocks. The encouraging feature this week is a batch of inquiries for steel-making irons. Close inquiries shows that the inquirers have very little iron under contract and have a good deal of work to cover. A symptom indicative of stronger quotations is manifested in the withdrawal in many instances of minimum quotations. Southern makers are canvassing this territory without much result up to date. The general feeling is that by holding a little, makers can easily command 25 or 50c. per ton more. Some furnaces have only a limited supply of coke under contract and coke is hardening in price rapidly. Recent developments have brought out urgent inquiries for additional No. 3 foundry to protect some cast-iron pipe contracts that may be closed within a month. No. 2 X foundry is quoted at $15 @15.25 with a chance of $15.50 before Saturday. Basic is $14.50 now with a chance to go higher. Low phosphorus is moving in small prompt-delivery lots at $19, with $19.50 quoted on a recent inquiry.

Billets—Billets are still quoted $22.40 @23.40. Business is light notwithstanding consumers have very little stock outside of two or three instances.

Bars—Iron and steel bars do not respond to the general improvement. Quotations 1.22½@1.25c. for ordinary and 1.27½@1.33½c. delivered for refined.

Sheets—All sorts of work into which sheets enter is more abundant than it has been for many months; as a result much business has come in within a week, of an anticipatory character.

Pipes and Tubes—Much new work is now ready for the placing of contracts. Some buyers discover they have delayed too long, as prices have been marked up on all kinds of pipe, notably galvanized.

Plates—The week's business consists mainly of small orders for local building work. Quotations have been advanced on this character of work. The 1.30c. rate holds good on most business.

Structural Material—While the volume of business has been moderate for the week quite a lot of held-up work is now being heard from. A good deal of bridge work is to be undertaken in the Atlantic coast states very soon, mostly in small orders. A large export order has been secured for Asiatic delivery.

Scrap—More interest is shown in the scrap market than for many weeks. Prices continue low and decidedly in buyers' favor. Dealers say they have not gotten rid of much stock but they are anxious to, as they have a large supply of material which they want room for as well as buyers.

Pittsburg

Mar. 19—Interest in pig iron continues in the local market. There have been no large single lots sold, but there has been continued small buying, with prices still tending to advance.

The coal situation has become very serious. Evidently there was much less stocking than was the case prior to the suspension of two years ago, and relatively fancy prices are now being paid, up to $1.60 for slack and $1.75 for mine-run, at mines, Pittsburg district. Connellsville furnace coke has been selling at $2.10 for a week. Prices are likely to advance, rather than decline, and a suspension of mining is, of course, a certainty. The effect will be to curtail iron and steel production, but consumption is likely to be affected still more, and the net result will probably be unfavorable to the iron and steel industry.

Demand for finished-steel products has increased, on the whole, but in some departments has decreased. Specifications for steel bars, for instance, are altogether unsatisfactory, the agricultural implement interests not taking hold as expected. Evidently they are thinking more of politics than of good crops. Taken altogether, the finished-steel situation is not nearly as good, in the second half of March, as was expected even so late as February. Prices are almost wholly unsatisfactory, the whole situation in a nutshell being that prices do not respond to demand as has always been the case in the past.

Bars are quotable at 1.10c., plates at 1.10@1.15c. and structural shapes at 1.12½@1.15c. Some of the mills are quoting decidedly higher prices than others, and it is the lowest-priced mill which makes the market for all who want to sell. There is considerable comment upon the fact that while the Carnegie Steel Co.'s stiffness in the matter of structural shape prices has been well advertised, the American Bridge Co. continues to sell fabricated steel at very low figures, the net result being that the United States Steel Corporation is as actively in the market for structural business as ever.

Pig Iron—There has been continued buying of bessemer iron in relatively small lots, chiefly by the steel-casting concerns. In the past week half a dozen lots have been taken, ranging from 1000 to 2500 tons, and aggregating over 10,000 tons, all at $14.25, Valley, to which the market advanced after the recent large sales of about 125,000 tons on the basis of $14, Valley. Basic iron has sold at $13, Valley, and at a trifle above that price, in moderate-size lots. The American Rolling Mill Co. is inquiring for 10,000 tons and the Colonial Steel Company for 5000 tons. The Wickwire interest at Buffalo took 12,000 tons of basic on the Algoma Steel Co.'s large inquiry, the balance of the iron being still unplaced. A sanitary-ware interest has been buying local iron, for second quarter, having lately bought about 2500 tons of Southern for a plant at Louisville. We quote: Bessemer, $14.25; basic, $13 for early delivery and $13.25@13.50 for extended delivery; No. 2 foundry, $13.25; malleable, $13@13.25; forge, $12.75, all at Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market continues very quiet, with prompt and forward quoted at $41, Baltimore.

Steel—Mills making openhearth steel in this district are still desirous of booking business; while bessemer steel is almost out of the market. There is not much inquiry, except that a few sheet and tin mills have tentatively sounded the market for second half, without any business resulting. We quote f.o.b. Pittsburg district mill: Bessemer billets, $20; sheet bars, $21; openhearth billets, $19.25@19.50; sheet bars, $19.50@20; f.o.b. Youngstown district mill bessemer billets, $19.25@19.50; sheet bars, $20@20.50 per ton.

Sheets—Business is coming in more freely, and a number of important sheet interests are practically filled to July 1. This is particularly the case with mills making specialties, such mills quoting relatively high base prices and full extras for all special finishes. There remain a few mills quoting very low prices on ordinary sheets: Black, 1.80c.; galvanized, 2.80c.; blue annealed, 1.35. The price quoted on black is occasionally shaded. A meeting of the Association of Sheet & Tinplate Manufacturers will be held in Pittsburg on Friday to discuss general trade conditions.

St. Louis

Mar. 18—The coal troubles are seriously affecting the iron market, and the general expectation of a strike and stoppage of supplies is holding back buyers. Prices are nominally unc' anged, but sales have been few.

Iron Ore Trade

The movement of Lake Superior iron ore from Lake Erie docks to furnaces in February was only 39,259 tons. These

light shipments were due to the severe weather. There were many interruptions to railroad traffic, and the ore piles were frozen so deeply that it was almost impossible to handle them.

It is understood that the unloading charges on iron ore at Lake Erie docks are to be reduced from 15c. per ton, last season's rate, to 8 or 9c. The old charge was considered too high. Other changes in ore rates are said to be under consideration.

British Ore Imports—Imports of iron ore into Great Britain in January were 681,240 long tons in 1911, and 578,409 in 1912; decrease, 102,831 tons. Imports of manganese ore were 64,858 tons in 1911, and 33,253 in 1912; decrease, 31,605 tons.

Foreign Iron Trade

Swedish Iron Trade—Iron and steel production in Sweden for the full year was as follows, in metric tons:

	1910	1911	Changes	
Pig iron.....	604,300	633,800	I.	29,500
Wrought iron.....	150,500	146,700	D.	3,800
Converter ingots...	97,900	93,800	D.	4,100
Open-hearth ingots	370,700	364,400	D.	6,300

In 1911 there were in operation 96 blast furnaces, 212 puddling furnaces, 18 bessemer converters and 52 open hearth furnaces. Exports for the year were as follows:

	1910	1911	Changes	
Pig and scrap.....	143,500	158,400	I.	14,900
Ingots, blooms, etc.	70,400	67,400	D.	3,000
Bars and wire rods.	150,700	169,300	I.	18,600
Other finished.....	56,700	23,200	D.	33,500

The total exports were 421,300 tons in 1910, and 418,300 in 1911; a decrease of 3000 tons.

British Blast Furnaces—On Dec. 31 there were 318 furnaces in blast in Great Britain. The average number active in the last quarter of 1911 was 314. There were 11 new stacks building at the close of the year.

METAL MARKETS

New York, Mar. 20—The metal markets showed some spectacular movements during the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Jan. 1912..	$ 1,915,202	$ 5,165,543	Imp. $3,250,341
" 1911..	923,676	9,540,830	Imp. 8,617,154
Year 1912..	1,915,202	5,165,543	Imp. 3,250,341
" 1911..	923,676	9,540,830	Imp. 8,617,154
Silver			
Jan. 1912..	6,027,905	4,358,009	Exp. 1,669,896
" 1911..	5,651,076	3,551,426	Exp. 2,099,650
Year 1912..	6,027,905	4,358,009	Exp. 1,669,896
" 1911..	5,651,076	3,551,426	Exp. 2,099,650

Exports from the port of New York, week ended March 16: Gold, $47,500; silver, $1,396,215, chiefly to London. Imports: Gold, $786,225, principally from France and Mexico; silver, $108,945, largely from Central America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Demand for India has declined a little. In New York more gold was taken for shipment to Argentina.

The net imports of gold into India in February were £5,174,600, being more than double those reported in February of last year.

Iridium—There is nothing new in this market. The price is $64 per oz., New York.

Platinum—The market continues quiet, with only a moderate business. We continue to quote $45.50 per oz. for refined platinum, and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Mar. 16, that prices are unchanged at 10 rubles per zolotnik for crude metal, 83 per cent. platinum at Ekaterinburg, and 38,500 rubles per pood for the same grade at St. Petersburg—equal to $37.60 and $37.73 per oz., respectively. These prices are nominal and subject to negotiation. The stock of platinum held by speculators is rather large, but they are not pressing sales, as higher prices are expected.

Silver—The market is without feature. Price continues steady and no great fluctuations are indicated. A corner in India for the next settlement has advanced the price of spot silver, but the future quotation indicates that the general situation does not participate in this local settlement price in India.

SILVER AND STERLING EXCHANGE

Mar.	14	15	16	18	19	20
New York....	58⅛	58⅜	58⅛	58⅜	58⅛	58⅛
London.....	26 1/16	26⅞	26 1/16	26⅞	26 1/16	26 1/16
Sterling Ex..	4.8720	4.8720	4.8720	4.8735	4.8740	4.8735

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

LONDON

Mar.	Copper Spot	Copper 3 Mos	Copper Best Sel'td	Tin Spot	Tin 3 Mos	Lead, Spanish	Zinc, Ordinaries
14	64 1/16	65 5/16	68¾	191¼	187¾	15 1/16	26⅜
15	65 1/16	65¾	69	191¾	188¼	16 1/16	26¼
16	.....	.....	.....	.....	.....	.....	.....
18	64 1/16	65 5/16	69	191¼	187¾	16 1/16	26
19	65	65 1/16	69	191¼	187⅝	16 5/16	26
20	65⅞	66 5/16	70	189¾	187	16¼	26

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

NEW YORK

Mar.	Copper Lake, Cts. per lb.	Copper Electrolytic, Cts. per lb.	Tin Cts. per lb.	Lead New York, Cts. per lb.	Lead St. Louis, Cts. per lb.	Zinc New York, Cts. per lb.	Zinc St. Louis, Cts. per lb.
14	14⅛ @14¾	14.40 @14.45	42¾	4.00	3.97½ @4.00	6.65 @6.75	6.50 @6.60
15	14⅛ @14¾	14.42½ 14.47½	42¾	4.00	3.97½ @4.00	6.55 @6.75	6.40 @6.60
16	14⅛ @14¾	14.45 @14.55	42¾	4.00	3.97½ @4.00	6.55 @6.65	6.40 @6.50
18	14⅛ @14¾	14.55 @14.60	42¼	4.00	3.97½ @4.00	6.55 @6.65	6.40 @6.50
19	14⅛ @14¾	14.55 @14.70	42¼	4.10	4.07½ @4.10	6.50 @6.60	6.35 @6.45
20	14⅝ @14⅞	14.65 @14.75	42	4.10	4.07½ @4.10	6.50 @6.60	6.35 @6.45

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—At the close of our last report all of the principal agencies were asking 14.60@14.62½c., delivered, usual terms, for electrolytic copper and the market, although dull, had a firm undertone. On Mar. 14 a good demand, especially from domestic sources, developed, which in the course of the next day or two cleaned up all of the copper that the agencies were willing to sell at their previous price. The demand continuing, the price naturally advanced, but in this movement there was considerable irregularity, both among the agencies and among transactions during the same day. Some agencies quoting the top price were able to realize it while others were selling for less. On Mar. 18 the market became very well established on the basis of 14¾c., delivered, usual terms. On Mar. 19 some rather large business was done at the previous price during the morning. In the afternoon certain sellers advanced to 14⅞c., delivered, usual terms, and consummated some important business at that price, while others were offering at ⅛c. less up to the close of the day. On Mar. 20, however, the market became 14⅞c. all around, with sales at that price. Altogether the transactions of the week have run to a fairly large total. The circumstances have been rather peculiar inasmuch as several sellers of Lake copper have reported but insignificant business in that kind of metal, which has been offered at 14¾c. right along. Europe participated in the movement of this week, but contrary to the usual practice did not take the lead. The close is strong at 14⅝@14⅞c. for Lake copper; 14.65@14.75c. for electrolytic copper in cakes,

wirebars or ingots, while casting copper is quoted nominally at 14¼@14½c. as the range for the week.

The London standard market remained practically stationary until Mar. 19, but on Mar. 20 a sharp advance took place, the close being firm at £65 17s. 6d. for spot, and £66 11s. 3d. for three months.

Copper sheets have been advanced 1c. and are now 20@21c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire has also been advanced to 15¾c. base, carload lots at mill.

Copper exports from New York for the week were 3533 long tons. Our special correspondent gives the exports from Baltimore at 1613 tons.

Visible stocks of copper in Europe, Mar. 15, are reported as follows: Great Britain, 36,370; France, 6610; Rotterdam, 3500; Hamburg, 7600; afloat from Chile, 2450; afloat from Australia, 5500; total, 62,030 long tons. This is a decrease of 980 tons from the Feb. 29 report.

Tin—The market advanced on Mar. 14 on the London Metal Exchange and held this advance fairly well throughout the week. The frequent and violent fluctuations of former times seem, since the new contract went into effect, to have become a thing of the past, and dealings at the Exchange have dwindled to almost insignificant proportions. The New York Metal Exchange is benefiting greatly by this state of things, as transactions in Straits tin—and these of fair proportion—are now almost of daily occurrence. Consumers in this market are buying good-sized quantities for future delivery. The market, both in London and here, closes lower but steady at £189 15s. for spot, and £187 for three months, and 42c., respectively.

Lead—The A. S. & R. Co. having evidently relieved itself of surplus supply, advanced its price to 4.10c., New York, on Mar. 19, but even at the advance outside sellers have not seen fit to enter the market. The situation at St. Louis is peculiar, because some buyers seem willing to pay more than the price at which the leading seller for the moment is supplying its customers, and also because of the disappearance of the ordinary difference between the New York and St. Louis price, which adds to the mystery of the situation in this metal. The close is firm at 4.07½@4.10c., St. Louis, and at 4.10c., New York.

The scarcity of lead in London, to which reference was made last week, is becoming still more acute, and prices have again advanced, the close being cabled at £16 5s. for Spanish lead, and 2s. 6d. more for English.

Spelter—The market for this metal during the week of Mar. 13-20 has been unsettled at a material recession in price, but probably it has not become so weak as appears on the surface. There were signs of a reversal a week ago when some sellers who had been able to collect some spelter available for early delivery by operations releasing previous sales of bonded spelter, and otherwise, found that they were unable to realize on tonnages the fancy prices obtained for occasional carloads. On Mar. 14, a rather large tonnage of April-May spelter was sold at about 6.55c., St. Louis. On Mar. 15, a leading buyer sounded the market with requests for offers on a round lot of April spelter and, so the story goes, was offered so much that he withdrew to observe things. Since then, spelter for early delivery in rather large quantities has been offered down to 6.45c., and lower. The events of the week have put this market more nearly on an even keel, and the spread in prices according to deliveries has largely disappeared, although now and then a premium is still realized upon occasional carloads required for immediate shipment. The close is unsettled at 6.35@6.45c., St. Louis, and 6.50@6.60c., New York.

The London market is weaker, the close being cabled at £26 for good ordinaries, and £26 5s. for specials.

Zinc dust is quoted at 7⅛@7¼c. per lb., New York.

Base price of zinc sheets is $8.50 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

At the annual meeting of the Granby Mining & Smelting Co., in St. Louis, it was voted to construct a zinc smelter at Roselake, a suburb of East St. Louis, where the company recently acquired property. The following officers and directors were reëlected: Elias S. Gatch, president; Norris B. Gregg, vice-president; Kennett Burns, secretary, of Chicago, H. O. Edmonds, of Chicago, and J. H. Grover.

Other Metals

Aluminum—The market is quiet and prices are off a little. Current quotations are 19@19¼c. per lb. for No. 1 ingots, New York. A recent German quotation is 12 marks per 100 kg., equal to 12.98c. per lb. for No. 1 ingots.

Antimony—Business is a little better. Cookson's has been advanced to 7⅝c. per lb. Other brands remain unchanged, Hallett's being quoted at 7⅜@7½c., while 6¾@6⅞c. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market is firm and rather active, but current prices are a little lower. The New York quotation is $45 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $44.50 for domestic orders, and $42 for exports. The foreign market is stronger, and the London price has been advanced 5s., to £8 12s. 6d. per flask, with £8 10s. quoted from second hands.

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 16—The base price paid this week for 60% zinc ore was $53@54 per ton. The base price paid for 80% lead ore was $50@51 per ton; the highest price paid was $52 per ton.

SHIPMENTS, WEEK ENDED MAR. 16

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Shullsburg	1,079,600	87,400	.....
Mineral Point	973,140	.....	.....
Galena	650,300	.....	.....
Benton	619,100	.....	261,300
Hazel Green	509,700	.....	.....
Platteville	452,850	.....	.....
Cuba City	219,140	83,570	225,300
Harker	78,990	.....	.....
Linden	66,750	.....	64,200
Highland	59,600	.....	.....
Total	4,709,170	170,970	550,800
Year to date	40,822,680	1,149,140	3,636,780

Shipped during week to separating plants, 1,348,370 lb. zinc ore.

Joplin, Mo., Mar. 16—The highest price paid for zinc-sulphide ore was $58, the base per ton of 60% zinc was $52@55. Zinc silicate sold on a base of $25@28 per ton of 40% zinc. The average price, all grades of zinc, is $50.30. As high as $54.50 per ton was paid for lead, but later purchases were shaded to $52. The average price, all grades of lead, was $53.50 per ton.

SHIPMENTS, WEEK ENDED MAR. 16

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,138,550	.....	850,060	$130,575
Joplin	1,940,160	.....	273,510	59,765
Duenweg	1,106,100	.....	76,400	30,820
Alba-Neck	1,056,100	.....	.....	29,570
Oronogo	841,630	.....	62,320	17,877
Galena	494,860	.....	70,400	14,765
Cave Springs	423,200	.....	.....	11,000
Granby	63,070	495,760	2,690	9,180
Miami	254,060	.....	87,690	8,200
Quapaw	252,410	.....	.....	6,310
Spurgeon	121,330	170,000	.....	5,585
Carl Junction	179,970	.....	.....	5,130
Carthage	194,610	.....	.....	5,059
Jackson	164,830	.....	.....	4,120
Wentworth	64,270	.....	.....	1,606
Lawton	60,470	.....	.....	1,570
Stott City	59,080	.....	.....	1,477
Aurora	.....	66,000	.....	985
Totals	11,414,700	731,760	1,423,870	$343,594
11 weeks	107,624,970	6,133,660	16,884,980	$3,014,102

Blende val., the week, $294,238; 11 weeks, $2,461,562
Calamine, the week, 11,255; 11 weeks, 85,769
Lead value, the week, 38,101; 11 weeks, 466,771

MONTHLY AVERAGE PRICES

Month	Zinc Ore: Base Price		Zinc Ore: All Ores		Lead Ore: All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	.....	38.45	.....	54.57	.....
April	38.88	.....	37.47	.....	56.37	.....
May	38.25	.....	36.79	.....	55.21	.....
June	40.50	.....	38.18	.....	56.49	.....
July	40.75	.....	38.36	.....	58.81	.....
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59.33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.25	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Report of $58 base price for zinc-sulphide ore was made. Such price was paid for under-grade ore heavy in iron, and out of the class of ore upon which prices are quotable. Buyers of ore heavy in iron frequently make these freak bids rather than tell the producer no deduction will be made under 4% of iron content. One lot of ore sold last fall at an equivalent of $60 base, and if such quotations were to be used as the market there would be no regularity of quotations and no dependence could be placed upon them.

Other Ore Markets

Manganese Ore—The price for domestic ores, as fixed by large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49 per cent., or over in manganese, not over 0.20 phosphorus and 8 per cent. silica. Prices range down to 23c. per unit for 40 per cent. manganese; with deductions for excess phosphorus and silica.

These prices are put at a high level to encourage exploration for manganese deposits in the United States. Most of the manganese ore used here is imported—from India, Brazil and Russia—and is bought abroad on the open market, usually at prices below those quoted.

The latest quotations in Great Britain are: Indian or Brazilian ore, 50 per cent. manganese, 19@19½c. per unit; 45 per cent., 17½@18c. Caucasian, 50 per cent., 16@16½c.; 48 per cent., 15½@16c. per unit.

Chemicals

New York, Mar. 20—The general market shows some increase in activity.

Copper Sulphate—A good demand is manifest. Prices are unchanged at $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

Nitrate of Soda—The spring business is opening. A heavy demand in Europe and high ocean freights have contributed to an advance in prices. Quotations are now 2.32½c. per lb. for spot nitrate, and 2.30c. for futures.

Arsenic—Spot supplies are still scarce. Mexican production is limited and Canadian shipments are very slow in coming forward. Quotations are higher at $3@3.12½ per 100 lb. for white arsenic.

Sulphuric Acid—The Interstate Commerce Commission has decided that present rates for the transportation of sulphuric acid in carloads from the Tennessee Copper Co.'s plant, Copperhill, Tenn., to certain points in North Carolina, South Carolina, Georgia and Florida, are unreasonable, and lower maximum rates are prescribed for the future. Reparation is awarded for past overcharge.

Petroleum

Exports of mineral oils from the United States in February were 99,219,249 gal. For the two months ended Feb. 29 the total exports were 225,392,186 gal. in 1911, and 231,409,456 gal. in 1912; an increase of 6,017,270 gal., or 2.7% this year.

Mining Stocks

New York, Mar. 20—On Mar. 14 there was an upward turn on the Exchange. The Curb was active on industrial stocks, but mining stocks were slow and irregular.

Mar. 15 there was active trading on the Exchange, but very slight changes in quotations. On the Curb trading was slow and mining shares showed few changes. There were sales of Homestake at $86.50@89.50 per share.

Mar. 16 there was some reaction on the Exchange and quotations were generally lower. On the Curb business was irregular. The copper stocks were in some demand at fractional recessions, while other mining stocks were firm, but not active.

Mar. 17 the Exchange showed recovery from the reaction of the previous days. Amalgamated Copper touched 74½, while Steel Common also gained. On the Gurb coppers were rather quiet, with the exception of Ray Central. Porcupines were active, and other mining stocks sold fairly well. Standard Oil stocks and Lehigh Valley Coal Sales Co. advanced.

Mar. 19 the advance on the Exchange was fairly well held. On the Curb there were active dealings in Lehigh Valley Coal Sales Co. at an advance. Mining stocks were rather slow, with the exception of the coppers. On Mar. 20 the Exchange continued generally firm, but the Curb was rather irregular.

Boston, Mar. 18—After a brief period of dullness and a downward tendency in mining shares the market has come back again and now shows a fair amount of activity as well as strength. The persistent strength of Amalgamated shares has considerable to do with this for that issue is selling at a new high on the present move.

The feeling is growing that copper shares are in for a great big broad active time and at material advances. The fact that big interests do not attempt to create a bull market in copper shares acts as a deterrent so far as the outside public is concerned.

The soliciting of proxies for the annual meeting of the Mayflower Mining Co. has resulted in giving the brokerage house of Fitzgerald, Hubbard & Co. control through the St. Mary's Mineral Land Co.'s ownership of 25,000 shares of Mayflower. These two interests will amalgamate and throw over 60,000 of the

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Dec.	Jan.	Feb.
Alaska shipments.	4,995,008	3,701,010	.....
Anaconda	23,500,000	26,350,000	27,450,400
Arizona, Ltd.	3,100,000	3,200,000	3,020,000
Balaklala	.....	.....	.....
Copper Queen	8 365,265	6,748,264	6,046,860
Calumet & Ariz.	4,486.000	4,544,000	4,452,004
Detroit	1,969,313	1,941,970	2,008,370
East Butte	1,498,000	1,520,000	.....
Mammoth.	1,721,404	1,665,319	.....
Mason Valley	.....	600,000	.....
Miami	2,500,000	2,600,000	.....
Nevada Con.	4,679,674	6,309,228	.....
Old Dominion	2,610,000	2,044,000	2,039,000
Ray	2,660,000	2,476,945	2,140,000
Shannon	1,255,858	1,550,000	1,300,000
South Utah	267,514	189,678	.....
United Verde*	2,000,000	2,000,000	.....
Utah Copper Co.	9,039,557	8,156,612	.....
Lake Superior*	17,500,000	17,500,000	19,000,000
Non-rep. mines*	8,500,000	8,400,000	.....
Total production.	100,647,593	101,497,026	.....
Imports, bars, etc.	21,101,256	31,790,590	.....
Total blister	121,748,849	133,287,616	.....
Imp. in ore & matte	5,159,997	8,340,740	.....
Total	126,908,846	141,682,356	.....
Brit. Col. Cos.:			
British Col. Copper	.....	.....	.....
Granby	.....	1,607,558	.....
Mexican Cos.:			
Boleo	2,645,640	2,315,040	2,204,720
Cananea	3,706,000	3,552,000	.....
Moctezuma	2,864,464	2,732,867	2,687,712
Other Foreign:			
Cape Cop., S. Africa	701,120	784,000	786,440
Kyshtim, Russia.	1,570,000	.....	.....
Spassky, Russia.	721,280	795,200	.....
Famatina, Argen.	217,280	172,480	.....
Tilt Cove, Newf'd.	.....	153,257	109,059
Exports from:			
Chile	5,824,000	8,064,000	6,720,000
Australia	11,200,000	7,056,000	7,164,000
Arrivals in Europe from other count.†	16,331 840	13,144,320	10,868,680

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
II, 1911	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167.904
II	116,035,809	56,228,368	63,148,096

	VISIBLE STOCKS		
	United States	Europe	Total
III, 1911	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,381,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

100,000 shares against the Fay management. Fluctuations of this stock, as well as of Old Colony, have been within narrow limits the past week.

Butte & Superior has risen almost $3, during the week close to $28 per share.

Assessments

Company	Delinq	Sale	Amt
Alameda, Idaho	Apr. 1	.....	$0.005
Algomah, Mich	Jan. 22	.....	1.00
Alpha Con , Nev	Feb. 21	Mar. 13	0.05
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah	Feb. 6	.....	0.01
Boston Ely, Nev	Jan. 18	.....	0.50
Challenge, Nev	Mar. 5	Mar. 26	0.05
Crown Point, Nev	Mar. 28	Apr. 19	0.05
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Ely Con., Nev	.....	.....	0.05
Exchequer, Nev	Feb. 14	Mar. 6	0.05
Hancock, Mich	Mar. 28	.....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
King David, Utah	Feb. 13	Mar. 6	0.005
Lehi Tintic, Utah	Feb. 29	.....	0.01½
Lower Mammoth, Utah	Mar. 16	.....	0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
Ojibway, Mich	Jan. 10	.....	1.005
Raven, Mont	Feb. 1	.....	0.10
Savage, Nev	Feb. 14	Mar. 7	0.10
Sierra Nevada, Nev	Apr. 3	Apr. 24	0.10
Southwestern Miami, Ariz.	Jan. 15	.....	1.00
Tintic Central, Utah	Mar. 9	Mar. 27	0.005
Tintic Standard, Utah	Jan. 8	Feb. 5	0.00
Union Con., Nev	Feb. 20	Mar. 12	0.15
Utah, Nev	Jan. 19	Feb. 9	0.05
Wabash, Utah	Mar. 19	Apr. 10	0.10
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	.....	23.690	24.324	.....
April	53.221	53.325	.....	24.483	24.595	.....
May	53.870	53.308	.....	24.797	24.583	.....
June	53.462	53.043	.....	24.651	24.486	.....
July	54.150	52.630	.....	25.034	24.286	.....
August	52.912	52.171	.....	24.428	24.082	.....
September	53.295	52.440	.....	24.567	24.209	.....
October	55.490	53.340	.....	25.596	24.594	.....
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York: Electrolytic		New York: Lake		London, Standard	
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	.....	12.447	.....	54.704	.....
April	12.019	.....	12.275	.....	54.034	.....
May	11.989	.....	12.214	.....	54.313	.....
June	12.385	.....	12.611	.....	57.365	.....
July	12.463	.....	12.720	.....	56.673	.....
August	12.405	.....	12.634	.....	56.266	.....
September	12.201	.....	12.508	.....	55.253	.....
October	12.189	.....	12.370	.....	55.170	.....
November	12.616	.....	12.769	.....	57.253	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.973	.....

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	.....
February	41.614	42.962	August	43.319	.....
March	40.157	.....	September	39.755	.....
April	42.185	.....	October	41.185	.....
May	43.115	.....	November	43.125	.....
June	44.606	.....	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	.....	4.238	.....	13.122	.....
April	4.412	.....	4.262	.....	12.889	.....
May	4.373	.....	4.223	.....	12.984	.....
June	4.435	.....	4.292	.....	13.260	.....
July	4.499	.....	4.397	.....	13.530	.....
August	4.500	.....	4.406	.....	14.260	.....
September	4.485	.....	4.356	.....	14.744	.....
October	4.265	.....	4.139	.....	15.332	.....
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	.....	5.413	.....	23.016	.....
April	5.399	.....	5.249	.....	23.743	.....
May	5.348	.....	5.198	.....	24.375	.....
June	5.520	.....	5.370	.....	24.612	.....
July	5.695	.....	5.545	.....	25.006	.....
August	5.953	.....	5.803	.....	26.801	.....
September	5.869	.....	5.719	.....	27.750	.....
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	.....	14.65	.....	14.96	.....
April	15.90	.....	14.65	.....	15.00	.....
May	15.90	.....	14.30	.....	14.72	.....
June	15.90	.....	14.06	.....	14.56	.....
July	15.90	.....	14.03	.....	14.53	.....
August	15.90	.....	14.00	.....	14.47	.....
September	15.90	.....	13.57	.....	14.40	.....
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14.25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS Mar. 19

Name of Comp.	Bid.
Acacia	.05¾
Cripple Cr'k Con.	.01⅝
C. K. & N.	.16
Doctor Jack Pot	.06
Elkton Con.	.59¾
El Paso	.70⅝
Findlay	.04
Gold Dollar	.13
Gold Sovereign	.02
Isabella	.12
Jack Pot	.05
Jennie Sample	.04¾
Lexington	.01
Moon Anchor	.008
Old Gold	.03¼
Mary McKinney	.54
Pharmacist	.01½
Portland	.90¾
Vindicator	.71½
Work	.01

SALT LAKE Mar. 19

Name of Comp.	Bid.
Beck Tunnel	.16
Black Jack	.16
Carisa	‡.15
Cedar Talisman	.01¾
Colorado Mining	.30½
Columbus Con.	‡.22
Daly-Judge	‡10.00
Grand Central	.63
Iron Blossom	1.30
Little Bell	.35
Lower Mammoth	.04½
Mason Valley	12.00
May Day	.15
Nevada Hills	2.30
New York	‡.03
Prince Con	1.15
Silver King Coal'n	1.55
Sioux Con.	.05½
Uncle Sam	.25
Yankee	‡.15

TORONTO Mar. 19

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡7.05	Pearl Lake	.22
Hudson Bay	‡70.00	Porcu. Gold	.47
Temiskaming	.39	Porcu. Tisdale	.03
Wettlaufer-Lor	.69	Preston E. D	.11
Apex	.06	West Dome	.50
Central	4.12½	Standard	.24
Dobie	.65	Foley O'Brien	.34
Dome Exten	.54	Rea	.78
Hollinger	13.25	Crown Chartered	.28
Imperial	.05¾	Swastika	.24½

SAN FRANCISCO Mar. 19

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.08	Belmont	10.40
Belcher	.74	Jim Butler	.65
Best & Belcher	.19	MacNamara	.27
Caledonia	3.95	Midway	.38
Challenge Con	.31	Mont.-Tonopah	2.37½
Chollar	.09	North Star	.33
Confidence	1.05	West End Con	.90
Con. Virginia	.75	Atlanta	.23
Crown Point	.76	Booth	.11
Gould & Curry	.17	C.O.D. Con	.11
Hale & Norcross	.34	Comb. Frac	.18
Mexican	3.55	Jumbo Extension	.45
Occidental	.60	Pitts.-Silver Peak	1.37½
Ophir	1.45	Silver Pick	.12
Overman	2.00	St. Ives	.33
Potosi	.09	Tramp Con	‡.01
Savage	.27	Argonaut	2.25
Sierra Nevada	.29	Bunker Hill	‡5.50
Union Con	1.15	Cent. Eureka	‡.30
Yellow Jacket	1.10	So. Eureka	‡5.00

N. Y. EXCH. Mar. 19

Name of Comp.	Clg.
Amalgamated	74½
Am. Agri. Chem	61¾
Am.Sm.&Ref.,com	77
Am. Sm.& Ref., pf.	104¾
Am. Sm. Sec., pf. B	86¼
Anaconda	39¾
Batopilas Min	1¼
BethlehemSteel pf	59¾
Chino	26½
Federal M.& S., pf.	40½
Goldfield Con	4⅞
Great Nor., ore ctf.	40
Homestake	90½
Miami Copper	24
Nat'nalLead,com.	55⅛
National Lead, pf.	107½
Nev. Consol	19½
Pittsburg Coal, pf.	80
Ray Con	17¾
RepublicI&S,com	21¼
Republic I & S, pf.	73
SlossSheffi'd,com.	45
Sloss Sheffield, pf.	‡100
Tennessee Copper	38¼
Utah Copper	57½
U. S. Steel, com	66¾
U. S. Steel, pf	111½
Va. Car. Chem	53

N. Y. CURB Mar. 19

Name of Comp.	Clg.
Barnes King	‡.12
Beaver Con	.47
Braden Copper	5¼
B. C. Copper	4½
Buffalo Mines	1¼
Butte & Vipond	‡.53
Butte Coalition	‡23
Caledonia	.68
Con. Ariz. Sm.	9/16
Davis-Daly	11/16
Diam'field-Daisy	13
Ely Con	5/16
Florence	.64
Giroux	4⅜
Gold Hill Con	¼
Greene Cananea	8½
Greenwater	.08
Guggen. Exp	206
Inspiration Con	18¾
Internat. S. & R.	‡128
Kerr Lake	2 1/16
La Rose	4
McKinley-Dar-Sa.	1 11/16
Min. Co. of A. new	3⅛
Nev. Utah M. & S.	1/16
Nipissing Mines	8⅛
Ohio Copper	1 7/16
Pacific Sm. & M.	⅞
Porcupine T'nsite	‡.03½
Precious Metals	‡1¾
Ray Central	2⅛
Red Warrior	‡1½
South Utah M. & S.	1/16
Standard Oil (Old)	825
Stand'd Oil of N.J.	363
Stand'd Oil Subs.	475
Stewart	1⅛
Tonopah	8
Tonopah Ex	2⅛
Tri-Bullion	⅜
Tularosa	⅝
United Cop., pfd.	15
Yukon Gold	3⅛

LONDON Mar. 20

Name of Com.	Clg.
Camp Bird	£1 10s 0d
Dolores	1 10 0
El Oro	0 18 0
Esperanza	1 12 6
Mexico Mines	7 2 6
Oroville	0 6 0
Stratton'sInd.	0 3 1½
Tomboy	1 0 7½

BOSTON EXCH. Mar. 19

Name of Comp.	Clg.
Adventure	7⅛
Algomah	5½
Allouez	41½
Am. Zinc	27⅛
Ariz. Com., ctfs.	4¾
Bonanza	40
Boston & Corbin	7¾
Butte & Balak	4
Calumet & Ariz	63¼
Calumet & Hecla	450
Centennial	19¼
Con. Mercur	.06
Copper Range	56¾
Daly West	6
East Butte	12⅞
Franklin	13⅛
Granby	35¾
Hancock	31½
Hedley Gold	18⅛
Helvetia	1¼
Indiana	14½
Island Cr'k, com.	43¼
Island Cr'k, pfd.	87
Isle Royale	27¾
Keweenaw	1¼
Lake	36
La Salle	5
Mass	7¼
Michigan	2⅝
Mohawk	56
New Arcadian	4½
New Idria Quick	8
North Butte	28¼
North Lake	6¼
Ojibway	6 3/16
Old Dominion	49
Osceola	112
Quincy	79
Shannon	12¼
Shattuck-Ariz	20
Superior	27½
Superior & Bost.	3 7/16
Tamarack	28
Trinity	5⅞
Tuolumne	4
U. S. Smelting	38¾
U. S. Smelt'g, pf.	48½
Utah Apex	2 1/16
Utah Con	16¼
Victoria	4½
Winona	6¾
Wolverine	108½
Wyandot	2¼

BOSTON CURB Mar. 19

Name of Comp.	Last
Ahmeek	255
Bingham Mines	3½
Boston Ely	1 1/16
Boswyocolo	.08
Butte Central	6½
Cactus	13
Calaveras	1⅝
Chief Cons	1⅝
Corbin	2⅛
Cortez	1 1/16
Crown Reserve	3 1/16
First Nat. Cop	2⅛
Majestic	.59
Mazatan	½
Moneta Porc	.15
Nevada-Douglas	3 1/16
New Baltic	4
Oneco	2⅛
Raven Copper	.38
Rhode Island Coal	.20
San Antonio	3
S. W. Miami	7
South Lake	6½
Trethewey	.65
Union Mines	‡⅛
United Verde Ext.	.36
Vulture	5

‡Last quotation.